Electricity Costing and Pricing Study

Volume X

Impact Study

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ELECTRICITY COSTING AND PRICING STUDY

VOLUME XA

IMPACT STUDY
INTRODUCTION AND CONSULTANT'S REPORT

Ontario Hydro
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I. INTRODUCTION TO VOLUME X(A & B)

A. PURPOSE AND DESCRIPTION OF IMPACT STUDIES

The impact study of the Electricity Costing and Pricing Study project was undertaken to assess the economic, societal, technological, and institutional effects of increases in rates for electricity and a structural change in rate design to rates based on marginal cost. Since the more feasible policies for rate design seem to be those based on either marginal costs or average costs, the effects of these two alternatives were examined in detail.

The usefulness of impact information covers at least the following areas:

1. Monitoring effects of rate changes to see whether objectives are being met and/or undesirable and indirect effects appear;
2. Uncovering unintended, delayed, higher-order effects of rate changes that produce either undesirable or beneficial impacts;
3. providing a backdrop of information about effects of rate change that can be used to formulate decisions on phasing of implementation, etc.;
4. providing cost-benefit studies of selective rate design features to ascertain net positive impacts (for example, of bulk metering)
5. providing a process that allows groups affected by a potential policy change to provide comments before the study is complete.

Hence the study of impacts goes beyond just examining the obvious or intended effects of rate change. The 1974 annual report of the U.S. Council on Environmental Quality linked the usefulness of impact statements to the exploration and understanding of secondary effects of a policy change. This class of studies involves analysing the interaction of the various effects of a policy change, such as a change in rate levels and structures. Of necessity, the approach must be interdisciplinary, developing and using suitable tools for situations where little data is available and the nature of relationships of variables is so complex and little understood that usual mathematical modelling is not practical. Broadly speaking, this approach to the impacts of policy studies is called 'technology assessment'. While there is an emphasis on searching for indirect impacts, the direct impacts are not forgotten, such as the study of the effects of change in rate policy on:

1. Employment,
2. Relocation potential of industries and Conservation.

While technology assessment was originally developed to assess the effects of new technologies, more recently the approach has been used for policy analysis. Selwyn Enzer performed some of the pioneering work in a paper entitled, 'A TA of a No-Fault Automobile Insurance System for the United States'. Thus when we read the term 'technology assessment' we may, for our purposes, substitute the words 'policy assessment'.

In the words of David M. Kiefer,

> *Technology assessment looks like a great idea. The argument goes something like this: science and technology have vastly benefited man and contributed to his well-being. At the same time, however, they all too often have done him and his environment much harm. Man has used his technology to dominate nature. Now, however, many may be dominated, in turn, by technology. TA is an attempt to establish an early-warning system to control, direct, and, if necessary, restrain technological development so as to maximize the public good while minimizing the public risks. It is not so much technology itself that is the monster, of course, but the way in which it is employed to bring about economic or social change.* [1]

When motorcars were first introduced, they were hailed as a pollution-free convenience, since they did away with the immense sewage problems of horse-drawn carriages. If, however, a TA of the motorcar had been possible at the turn of the century, then the congestion costs, division of communities by highways, accident costs, emission consequences, and other factors might have altered the way in which cars were introduced. Preventive action for mitigating unwanted consequences might have saved society some costs that were otherwise unavoidable.

Although impact studies can cover a wide spectrum of interests, public interest seems to be concentrating more on societal impacts: for instance, jobs, or changes in lifestyles due to conservation. Three selective examples of this trend are

1. In an important speech in 1975, the Chairman of the Alberta Gas Trunk Pipeline, said that the weight of public interest in impact studies had shifted from the environmental (or ecological) to the societal;
2. In 1975 the Ontario Municipal Board turned down a proposal to widen Yonge Street in Toronto, because the proposal had not analysed or reported on the effects on society;
3. Public response to Tennessee Valley Authority studies of rate change (and nuclear site impacts) has been more critical of the paucity of information on societal effects than of anything else.[2]

Although this trend towards interest in societal impacts is discernible, the state of the art of impact studies and the bulk of current analysis and description still lies in the other areas such as the economic, technological, and institutional.

The work of the Impact Committee produced the following papers:

Paper	Contents
1. Hittman Report	residential, commercial, industrial, PUC case studies, socio-economic model; analysis of interested parties.
2. Aggregate and Sectoral Studies	
(a) Large-User Industries and	(a) effects on electrically intensive industries and economy.

[1]David M. Kiefer, "Technology Assessment: A Layman's Overview", *Chemical and Engineering News* 48 (October 1970).

[2]See for example Tennessee Valley Authority, "Final Environmental Statement", Hartsville Nuclear Plants (1975), Volume II *Responses to Review Comments.*

(b) Pulp and Paper Industry	(b) a background study on the effects of changing rates on the pulp and paper industry. (This is not incorporated into the study, but its numerical conclusions are incorporated into (a).)
(c) Conservation Impacts	(c) another background study, on the effects of rate increases on the use of electricity.
(d) Effect on Work Hours	(d) a background study on how many hours workers must work to pay their electricity bills.
3. Internal Case Studies	
(a) Small Industry	(a) similar to Hittman case studies
(b) Guelph Municipality	(b) similar to Hittman case studies
(c) Preliminary Impact Study on Low-Income Households	(c) similar to Hittman case studies
4. Cost-Benefit Studies	(a) eliminating bulk metering of multi-family dwellings, where rewiring is not required.
	(b) of time-of-day rates for residential customers.

The Impact Committee used the three background studies to put its main study in perspective. New rate forecasts, and improved modelling of the effects of demand elasticities on the use of power, have made these studies outdated, and they are therefore not included in this report. The cost-benefit studies were performed by the Impact Committee for the Pricing Committee and can be found in Volume VIII.

Data Usage and Methodology

Case Studies

The case studies used an interview approach as the way of capturing potential future effects. Managers of various commercial and industrial establishments, as well as municipalities, were presented with two rate scenarios for each of the years 1978 and 1983. Scenario A was based on a projection of the present system of pricing,[3]

Scenario B was based on prospective marginal-cost-based rates. These scenarios were built because in September 1975 neither marginal costs nor marginal prices were available. When these (and also recast average-cost rates) became available close to the completion of the study, it became apparent that the impact findings based on the scenarios were directionally sound, but in some places magnitudes could be refined. Where refinement seemed necessary, new calculations were made and are incorporated into this report. Managers were asked what their response to the scenarios would be regarding company growth and employment, product shifts, energy conservation, and so forth. The advantage of this approach is that it projects us into the future based on the most up-to-date information a manager has available about his establishment. At the time of writing, much published data on electricity use in Ontario was available only as far as 1972, making future projections difficult without having the information on 1973-6 available in baseline data. Insofar as energy use patterns have changed after the energy crisis of October 1973, and continue to change in response to higher energy prices, data prior to 1973 will prove of limited use for future projections.

To the information obtained through interviews were added census-of-manufacturers forms for 1974. Managers were also asked to fill these out pro forma for 1978. Each establishment was chosen after an appraisal consisting of an evaluation of the company's position in its industry, availability of data, and electricity costs as a percentage of value added. Published material on each represented industry was used to evaluate managers' responses in each case study.

Residential case studies were hypothetical in nature, since a typical 'representative' household or 'low-income' household would be difficult to locate. Effects on percentage of family income spent on electricity were calculated using forecasts of family incomes.

Aggregate and Sectoral Studies

Insofar as company officials might not carry out their intentions as presented in the case studies, these needed to be supplemented by aggregate or sectoral studies based on projections from published data. These studies assessed the financial, technological, environmental, and economic positions of the following industries:

1. Abrasives,
2. Pulp and paper,
3. Industrial chemicals,
4. Petroleum Refineries,
5. Smelting and Refining,
6. Iron Foundries,
7. Cement,
8. Lime, and
9. Miscellaneous Petroleum and Coal Products.

The options and flexibilities resulting from electricity rate changes regarding profitability, employment, growth and location and other factors were assessed. Out of these options the most probable reactions were forecasted. The findings of the aggregate studies did not differ from those of the case studies.

Various futures research techniques were used in both case studies and aggregate studies. Scenario-building was common to both. Delphi forecasting of prices for energy other than electricity was used to test for the need to consider important fuel substitutions in the study. Forecasts of various types, such as labour productivity, inflation, family incomes, and electricity rates in other jurisdictions were also applied in studies as the need arose.

[3]For details, see the Hittman Report, Part 2 of this volume, Ch. III.

Role of Demand Elasticity

These impact studies were undertaken at a point in the project when customers' responsiveness to price changes - elasticities of demand - had not been measured. However, consideration of demand elasticities for electricity is implicit in the responses of managers interviewed in the case studies. Similarly the considerations given in aggregate studies to how industries may respond to changes in rate levels and structures also includes an implicit measure of demand elasticity for each industry's product package.

Lastly, a background paper was produced considering the effects of a range of real price increases and demand elasticities produced.

B. LIMITATIONS OF THE IMPACT STUDY

1. Data

Assessment of the effects of future pricing-changes should be done in the context of the availability of resources and the economic and social conditions that will prevail in that future period, and the values and standards that consumers and the public will use to judge the aptness and effectiveness of pricing changes. There are no generally accepted models or data banks available on what Ontario will be like at various future dates. This study has used several forecasts of such items as labour rates and levels of fuel prices. Models of the future and further forecasts of such items as consumer and public values would have improved the study, had they been available. For example, an economic input-output table for 1985 and 1995 would have helped greatly in measuring impacts. The Science Council of Canada has proposed constructing such tables, but has not yet received funding for the project. Modelling of living-space, mobility, modes of transport (e.g. electric car, electrified railways), appliances, type of goods produced, and the use of solar energy would greatly help future impact studies.

2. Comparative Studies

This is the first application anywhere, to our knowledge, of technology assessment techniques to rate studies. Impact studies of changes in electricity rates have been very few. Consequently this study represents a first step in a new generation of impact studies, which can draw little help from preceding studies. Other impact studies available to use are

1. Bonneville Power Administration, on increasing rate levels, 1973;
2. Tennessee Valley Authority, on generic effects of rate levels and marginal-cost pricing on the environment, 1975;
3. Rand Corporation, State of California, on electricity prices and income groups in California and Los Angeles, 1972; and
4. Federal Energy Administration, a study of the costing and pricing of electricity, with sections on impact, 1976.

All these studies treat impact analysis somewhat casually and with a sense of frustration. Data are amassed, but the central and most crucial aspect is lacking: namely, a methodology for analysing the data. The Rand study is something of an exception to this generalization; yet it restricts itself primarily to statistical analysis of impacts on customer bills, not their choices and reactions. Most of the impact studies listed above could be characterized as descriptive and narrative. A more detailed comparison of these studies can be found in Section G of this introduction.

3. Detail versus Comprehensiveness

One of the early choices an analyst must make is the one between study depth and detail on the one hand and comprehensiveness on the other. When higher-order impacts are examined, the cause-and-effect relationships that can be drawn will quickly tend to expand the scope of the study to include a variety of areas that only an army of analysts could tackle. Since resource allocation precludes a truly 'comprehensive' impact study, one is forced to select particular areas for analysis, such as direct employment effects. This is not an altogether satisfactory approach, since the approach of technology assessment is meant to uncover unintended and unexpected impacts, which by definition are ones not chosen for analysis at the outset. However, when impact studies are made along with a study of potential changes in rate policy, overall deadlines leave little room for analysing unexpected impacts uncovered close to the study's end.

C. IMPORTANCE OF ELECTRICITY COSTS

Another factor to keep in mind when reading this study is the relativity of electricity costs to other costs consumers face. While by necessity a study of the impacts of electricity rates must concentrate on electricity prices, one should remember that other costs and their impacts are usually more important to residents, commerce, and industry.

For instance, residential customers usually give more importance to the costs of shelter, food, clothing, liquor and tobacco, and entertainment; commercial customers to rent and interest rates; and industrial customers to materials, labour, plant and equipment, transport, and (again) interest rates. All three classes, of course, consider taxes a very important item.

Electricity costs as a percentage of average value added in manufacturing may climb from 1973 levels of about 1.7 per cent to about 2 per cent by 1978. As a percentage of gross family income, electric bills are expected to rise from about 0.9 per cent to 1.4 per cent by 1983.[4]

While these figures are very small, they are averages; and therefore some individuals and industries that do not represent the average may be affected significantly more, especially when the higher cost of electricity is added to all the purchases of the industry or individual concerned. For example, in 1975 a minimum-wage earner living in a house faced an energy bill of between 6 and 11 per cent of his gross wages, depending on where he lived. By 1979 he would pay between 13 and 16 per cent.[5] He might well then feel obliged to move to an apartment, where as a rule he would use less energy. There is no question that energy costs in general have had, and continue to have, profound effects on industry and society. Electricity cost increases represent a contributing factor to these effects; but when electricity is taken by itself, the severity of impacts is much reduced, since electricity represents only 14.2 per cent of the energy used in Ontario in 1973. Nevertheless, the importance of energy and electricity is very high, since without it industry could not operate or combine the other factors of production, and residential lifestyles would be severely affected.

A feature of the study design that should always be remembered is that of impact timing. In order to aid in decisions on how to phase in a new pricing policy it is necessary to first assume that

[4]See Section II, Ch. IV, Case-Study of Single-Family Dwellings.

[5]This calculation is not based on rates from Scenarios A or B, but on refined rates based on marginal cost, which were received towards the end of this study.

virtually the complete policy is introduced in one year, without a phase-in period. This is done to help determine where impacts are sufficiently severe to suggest a partial or selective strategy of phasing in to mitigate negative impacts.

D. HIGHLIGHTS OF PRINCIPAL FINDINGS

Although the impact findings are many and several would interest only particular groups, highlights are given below:

1. In the short run to 1980, the pricing of electricity will have little negative effect on employment. Rate increases may produce localized exceptions, mainly in the abrasives industry. Most customers should have little or no difficulty in adjusting to new rate structures. In fact, discussions with some representatives of industry suggest that replacing much of the flexibility used in ratemaking with well defined objectives such as efficiency, and therefore with concrete criteria, may be more important to them than an initial shift of some costs from municipalities to large industrial customers. One reason for this position may be that large users are more likely to realize the benefits of their own future conservation efforts under a marginal-cost pricing-system than under the more flexible criteria an average-cost pricing-system employes. Moreover, conservation by one class of customers, e.g., large users, would not increase the bills of the others.

   Under rates based on marginal cost, the customer heating his dwelling electrically also remains in a good position compared to users of oil and gas heating. In 1975, (with equivalent insulation) the all-electric customer would pay substantially more than the all-gas customer. The customer with oil heating is somewhere in between. By 1979, the range narrows. The all-gas customer pays the least, but his saving is not great when compared to the bill the all-electric customer pays. This would shift even more new homes to electric heating, and so increase the potential shortfall of generation. The customer with electric space-heating would be able to reduce the effect of his bill with optional time-of-use pricing if statistical load data for the electric heating portion of the load showed that the number of kilowatt-hours per off-peak hour was greater than the number of kilowatt-hours per peak hour. Off-peak hours represent about 54% of total hours in a week. During the day lighting, cooking, solar heat and body heat contribute to lower the heating load requirements. At the time of the study, insufficient load data was available to draw a definite conclusion.

   With current insulation, (that is, OEC for all-electric customers and, NBC for the others) average-cost pricing in 1979 separates the all-electric customer from other energy combinations by a relatively small range of costs.

   A negative impact is the change in outlook, procedure and equipment that local utilities must make to convert back to a policy of individual metering for multi-family dwellings. The other exception is the new large-use customer. During the first three years, the new large customer does not share in the benefits of historical investment. Consequently, new customers would for some time pay more for their electricity than old ones. Volume VIII has simulated the electricity bills for fifteen large customers using marginal-cost pricing. Some of them are expanding their take of electricity and some are conserving. Fifteen identical new customers would pay bills 47 per cent higher during their first three years with the system.

   In contrast, new residential customers would immediately share in the benefits of historical investment, paying exactly the same bills as identical old customers. The greater negative impacts within the general effects are mainly attributable to changes in the price level for electricity (and energy in general) rather than to a changeover to marginal-cost pricing.

2. In the long run, higher energy costs, of which the cost of electricity is but one, may cause a significant number of energy-intensive industries to expand in energy-endowed jurisdictions.
   Already, Alberta has the highest economic growth rate of any province in Canada. During 1976 its level of disposable income per capita surpassed Ontario's.[7] Protracted restrictions on capital for building nuclear plants would aggravate this situation. A restructuring of the economy towards expanding commerce and service industries that can also serve the other provinces, can mitigate the dislocations from no longer being the richest province in Canada. One of the planning-needs for easing such a change is to provide a price structure for electricity that will encourage conservation and efficient use. Marginal-cost pricing will serve this need better than average-cost pricing, as various results of the impact study have shown.

3. Case studies suggest industries will try to offset the effects of higher electric rates by using more recycled materials and generating more power for themselves; the trash incinerator-generator of Ontario Paper is an example.

4. In 1978 a minimum-wage earner using 500 kWh a month, would under average cost rates spend between 2.8 and 3.8 per cent of his gross income on electricity, depending on his municipality. Under illustrative marginal cost rates, he would spend between 2.8 and 3.4 per cent. This contrasts with 2.6 to 3.7 per cent in 1965. These estimates do not factor in the additional costs of any yearly increases in use of electricity. On the other hand, neither do they assume that the minimum-wage earner reduces his use because of the higher price.[8]

5. Municipal utilities are responding to increased costs by considering longer meter-reading periods of half a year or a year. If, in the mean time, customers are billed on an equal-billing basis, their efforts at conservation and efficiency may be frustrated. The residential customer might be especially encouraged to conserve if his bill each month would reward him. Long meter-reading periods and equal billing in the mean time may work against conservation and efficiency. This situation is aggravated by cases where water bills are added to electricity bills to provide the customer with a single bill. He may then again be unable to see the fruits of his efforts to use less electricity. A printout on the bill showing consumption for the previous month and for the year so far, with the corresponding figures for the previous year, would go far to encourage conservation and efficiency.

6. Three examples of unanticipated and/or higher-order impacts are these:

   a. A move back to metering multi-family dwellings individually may lead developers to build all-electric apartments in the future, since (i) individual metering is cheaper for

[7] See Addendum on Personal Disposable Income in Canada.

[8] For details of impacts at other levels of use, see *Section III, Chapter C.*

electricity than for gas and oil; and (ii) landlords would be spared the difficulties of trying to pass through increased energy costs at rent-review meetings.

b. Individual metering of electricity makes it easier to transfer responsibility for what are now common services (space-conditioning, for instance) to individual tenants.

c. Cement companies located on waterways which allow for lower-cost transport may expand grinding-operations (which are energy intensive) in Quebec, where electricity is cheaper, and then ship the clinker to Ontario to complete processing for the Ontario and New York State markets. This, however, involves only a negligible loss of employment.

Effects of Rate-Level Increases

Over a period of from two to three years, there would in general be little plant relocation to jurisdictions with lower energy costs, except perhaps in the abrasives industry. Direct negative employment effects in electricity-intensive industries arising from electricity rate level increases are estimated to be about 1048 jobs, or 2.7 per cent of their total 1972 labour force. Restructuring the economy through expanding the service sector might provide many more jobs in return than were given up in the growth of electrically intensive industries.

In the longer run, the picture may change. Walter Gordon expresses the view in his recent book that Canada's "competitive edge" in manufacturing has been its having lower energy costs[9] than the United States or Japan. This has mitigated the effects of our lower labour productivity and other factors in which our competitors have an advantage. *In part because of our lower oil prices, total production of goods and services in Canada increased by 2.8 per cent in 1974 compared with real declines in the OECD countries, as a group, of 0.1 per cent and in the United States of 2.1 per cent. Similarly, the Canadian unemployment rate averaged 5.4 per cent in 1974, lower than the 5.6 percent recorded in 1973.*[10]

As energy costs in Canada approach world prices, and catch up with U.S. oil prices, this edge will be lost. Electricity prices are expected to rise slightly less sharply than those of gas and oil. Consequently, one executive in the paper industry judged that rising electricity prices in Ontario would cause his firm to consider expanding in British Columbia and Quebec, where electricity prices are lower and a plentiful supply of timber is more important. He is also considering the trade-off between Ontario, with its rising electricity prices and lower rates for timber growth owing to northern climatic conditions and the U.S., with its higher electricity prices but more rapid rate of timber growth.[11]

Furthermore, some energy-intensive industries may respond to incentives from Alberta and move closer to the source of hydrocarbons. Yet the large markets and shorter transport distances that Ontario and the border areas of the U.S. can offer will lead many industries to remain here. The proximity of financial institutions and research houses in Ontario will be another factor. Finally, some U.S. companies that now export to Ontario and the rest of Canada may relocate here because of higher rates for electricity in New York State.

Thus we may expect some depressing effect on the Canadian export potential, as well as some adjustment in industrial growth rates of different provinces. The service industry is, however, more labour-intensive than manufacturing, and (as is typical of maturing economies) the growth of this sector in Ontario is what would mitigate the effects of a lower potential for energy intensive industrial growth. In the longer run technological developments designed to reduce the energy intensiveness of many industries may be used to mitigate the effects of high energy costs on industry location (see the GAMMA report: Tentative Blueprints for a Conserve Society in Canada).

In the abrasives industry electricity as a percent of value added has reached 25 per cent. In recent years the demand for their product has fallen, as substitutes and new processes in manufacturing become cheaper. The Canadian labour force in abrasives numbers about 5,000, of whom many are office workers with alternative employment skills. Although the three-year employment effect of electricity rates on the abrasives industry is estimated at a loss of 178 jobs, in the longer run additional family dislocations may occur, since world production is still concentrated in the Niagara Peninsula, the former source of low cost electricity. To remain competitive, the abrasives industry needs a world location with unpooled, on-site, hydro-electric power, preferably drawn from older depreciated stations so that the costs are at the barest minimum. Once pooling with more expensive fossil and nuclear stations is introduced, the rates tend to become too high. Although the competitive position of this industry is being threatened by technology and higher energy prices, government subsidies to the industry may not be supported on economic social grounds, or for the sake of Canada's balance of payments.

Under Scenario A, spending on electricity by residential families in North York was forecasted to increase from .86 per cent of gross income to 1.4 per cent by 1983. This figure also provides for an increase of about 12 per cent in kilowatt-hours consumed over 1975. Without an increase in consumption the 1.4 per cent would fall to about 1.2 per cent. The effects on families in other places would be similar. The effect on the poor can be higher, especially those living in poorly insulated dwellings. Take a wage-earner supporting a family, using 750 kilowatt-hours a month, and earning $2.40 an hour in 1975 (the minimum wage in Ontario). If his wages rose 10 per cent one year and 8 per cent the next, then by 1978, under average-cost pricing, he would spend between 4.0 and 5.0 per cent of his gross income on electricity, depending on which municipality he lived in of the eight studied. The effect on families is greatly eased since more wives are going out to work, and so adding to family incomes. Gross incomes were used in this forecast, rather than disposable incomes, because it is very hard to forecast taxes more than a year or two ahead.

The study of interested parties showed that AMPCO and the Consumers' Association agreed in generally opposing higher rates in principle. The Energy Probe and the Sierra Club favour higher rates as a means to conservation.[12]

Effects of Changes in Rate Structure

Industrial Case Studies and Sectoral Analyses

All participants in case studies said time-of-day rates would cause them to either use more off-peak power or at least assess this new option for its cost-effectiveness. Although most compa-

[9]Walter Gordon, *Storm Signals* (1975), p. 87.

[10]Energy, Mines and Resources Canada, *An Energy Strategy for Canada*, p. 19.

[11]For example, a pulp and paper company has recently located in Kenya because trees reach harvesting-maturity in only one fourth the time it takes in North America.

[12]A past president of the Sierra Club in the United States has also produced a position paper urging the adoption of marginal-cost pricing.

nies did not anticipate massive shifts in use, they would tend to shift electrically intensive operations to off-peak hours, especially operations lacking any high labour content and hence any large shift premium. Most electrically intensive production processes have relatively low labour content. With marginal-cost pricing, companies that used less power or shifted their use off the system peak would reduce their bills. For several industries, a precondition for expanding off-peak production is larger storage capacity for the intermediate product. This capacity would be added gradually, spreading the shift of electrical demand over several years.

In general, companies that already have a continuous three-shift weekend operation justified under present economic conditions may face lower production costs through time-of-day rates. For example, several pulp-and-paper operations already peak at night, even without a price incentive to do so. Companies that work on one or two shifts, and have so far refrained from adding another because the ratio of benefits to costs was unfavourable, may be induced to take the step. Although unions generally oppose more shift work on the grounds that this harms life-styles, there may be an incidental opportunity here to reduce our chronic unemployment somewhat through using present plant and capital more intensively. Some of those who will benefit may at present be unemployed and drawing welfare benefits.

Some firms served by municipalities did not know they could take interruptible power at reduced rates. These firms may have faced an uneven level of competition with similar ones that are direct customers of Ontario Hydro and have been taking interruptible power for several years.

Commercial Case Studies

Commercial firms were generally found to be less able to use off-peak rates because of the nature of their operations, which had to be carried on during normal business hours. The hospital studied peaked at about 7:00 a.m., posing a potential for lower demand if it could shift its peak to slightly before 7:00 a.m. without affecting patient care. On the whole, however, commercial establishments would respond their total and peak consumption to rates based on marginal costs. Thermostats could be set lower in winter and higher in summer, and peak-load controllers used where that would not cause perceptible deterioration in employee output or the comfort of customers and tenants. Since most commercial customers use less than 3000 kW, optional time-of-use rates would be needed to reward this class for using power off peak. Of all the commercial cases studied, the hospital was by far the largest, with a peak of 2880 kW in July 1975. This shows the potential for optional time-of-use rates for this class. It is the use of steam heating by the hospital (purchased from the Toronto Hospital Steam Corporation) that causes the hospital to peak its electricity use in the summer. Similarly if district heating were available at a competitive cost, this illustrates the potential for reducing winter peak loads and costs.

Analysis of Residential Impact

For residential customers, the rate structures are not as different as for large users, because

a. Time-of-day pricing is proposed for residential customers only on an optional basis.

b. In setting electricity rates, the demand charge is folded in with the energy charge.

c. The residential customer would not be offered interruptible rates.

The customer-charge feature will especially reward customers who wish to use less than the amount now covered by the minimum bill. However, the new system would provide lower bills for many other low users too: certainly throughout the rural retail system. Low-income households that were also low users of electricity ought therefore to reap the benefit of lower bills, although in certain municipalities that might not take effect immediately, because of a combination of unusual cost factors.

Many residential customers consider the flat rate feature replacing the declining-block rate to be more consistent with conservation principles. The declining-block rate favours the large residential user of electricity. The typical large user is an owner of a large single-family home with electric space-conditioning. Apartment dwellers with individual meters use about one third of the average consumption in a single-family dwelling. Private saunas and electrically heated swimming-pools may be very significantly affected by a departure from declining-block rates. So may cottage owners, in that some may decide electrical service is too costly given their particular circumstances.

Two studies, one by Ontario Hydro, the other for the U.S. Federal Energy Administration, showed that on the average 39 per cent and 34.5 per cent more energy is consumed in master-metered multi-family dwellings. Many low users of electricity may be regarded as subsidizing the high users of electricity in the building. In one recent case, an elderly lady telephoned to express her concern about her building's switch to bulk metering. Her present monthly bill was about $5; her rent increase to cover only her share of bulk-metered electricity costs was to be $14 a month. Although there are some costs associated with additional meter-reading and billing, these do not outweigh the very substantial energy savings that could be realized. Moreover, this shift in policy could create more jobs. It is therefore recommended that a plan should be drawn up to introduce a policy of individual metering as quickly as possible. One unintended higher-order effect is associated with this move. Developers favour a policy of individual metering, but feel that the ease of master metering electricity, coupled with the problems of rent-review legislation, would induce developers to make new apartment buildings all-electric: a situation which would tend to increase the overall consumption of electricity. In that event, there would be of course offsetting decreases in the consumption of oil and gas for space heating.

Effects on Interested Parties

In general, interested parties support marginal-cost-based pricing in principle. Some large industrial users believe that the method follows more clearly defined rules than the present one. Consequently, customers would accept rate changes more easily if they believed that all other customers' rates are founded on consistent criteria and pricing-principles, year after year. The conservationist groups are interested in the conservation effects of this pricing policy; in fact, they and the Consumers' Association would like to see time-of-day pricing extended to residential customers. Some customers however will object to any change in rate structure that would shift costs to them no matter how well founded in logic and practice it may be.

E. CONTINUING IMPACT ASSESSMENT

Continuing work on impact assessment involves three considerations: choosing the impact study team, refining impact study methods, and determining specific areas of study.

1. Choosing the Impact-Study Team

Impact studies draw on many disciplines and bodies of knowledge. Economics, forecasting, engineering, and sociology are some of the commonly found ingredients that are melded through the various techniques of futures research when we deal with potential policy changes that could take place some time in the future. The present Impact Committee had these skills except for ecology and sociology. The interdisciplinary teamwork is necessary because the effects of rate policies for electricity are so diverse, affecting among other things customer budgets, the economy, lifestyles, organizational structures and demands, technology, product lines, pollution, and conservation. The body of knowledge known as technology assessment is used for two key purposes: it provides some methods for assessing the complex inter-relationships among the various disciplinary impact analyses, and it concentrates on identifying and analysing some of the less obvious effects through a development of cause-and-effect chains and mutual feedback loops.

2. Refinement of Methods

The tools of impact analysis (or technology assessment, 'TA') have been under continuous improvement since the first technology assessments were done in 1967.

For example, let us consider the analysis of interested parties in this study. The exercise consisted of presenting the two previously described rate scenarios to various interest groups. Interviews were used to assess their responses to the scenarios. A matrix summarized the common and diverse interests. So far, this is very simple. Yet if one wishes to appreciate better how close or how far apart these groups are on various issues, and which issues really matter to each group and which do not, then one requires a more quantitative measurement. Such a refinement was developed at the University of British Columbia, using regression analysis and other methods to measure group divergencies, Judgement Theory.

Another example of refinement can be found in the diagram of cause-and-effect impact relationships described in this study. For instance, a doubling of bulk-power rates is eventually traced to a box called "personnel cutbacks" in industries that cannot pass increased costs through to the customer. Without any number on the box, it is hard to assess how important or severe this impact is compared to all the other socio-economic impacts in the diagram. Since we do not know the demand elasticities for each of the industry's products, traditional economic analysis may not afford much help. Neither would an economic input-output table using 1966 structural relationships help decide how structural changes and impacts would take effect in 1978, in 1983, and beyond. Refinements to the impact analysis may include assigning probabilities, and apportioning impact points, to each "box". Since these quantitative methods are more judgemental, it was decided not to use them in this first impact study.

We have discussed two of many refinements one could make in the analysis of impacts; developing and carrying through any of those would require additional resources for development and implementation.

3. Specific Areas of Study

Impact analysis can be continued in the following specific areas. For some, data is expected from the Federal Government and other sources.

1. The impacts of a rate increase or a change in pricing-policy should be monitored, to see whether the intended benefits are materializing, and whether negative impacts are being mitigated according to plan.
2. Proponents of lifeline rates maintain that low-income customers use less electricity than higher-income customers. In several rate cases in the United States, it has been argued that a significant number of low-income customers use more electricity, because of their more home-centred lifestyle. A Government sample survey, comparing each participant's electricity consumption, ought to help in analysing this question and several others. Data are now being collected for this study through a joint effort by Ontario Hydro, the municipal utilities, and Statistics Canada.
3. The energy input-output table of Statistics Canada could be applied to analyse the impact of electricity pricing changes on commodities.
4. The relationship of the demand for electricity and other kinds of energy to future economic performance in Ontario could be probed.
5. Forecasts the electricity rates of other jurisdictions, when compared with Ontario Hydro's, should help to continue the assessment of the potential for industries to relocate, both within Ontario and elsewhere.
6. How, and how far, does increased use of energy in households improve peoples' standard of living? An analytical tool of economics called 'taxonomY', used to compare standards of living from one country to another (where foreign-exchange rates can give misleading results), may be applied here, after some modifications.
7. Research could be carried out to improve the state of the art of impact assessment.
8. A sectoral study of impacts on commercial customers.
9. Further case studies and impact modelling would build on the foundations laid in this report.

Impacts of rate policy are not the only relevant impacts of an electrical utility's actions. Plant location, growth of energy demanded, and growth of the peak (although these latter two depend also on pricing) are some of the other variables that induce impacts both small and large, widespread and local, depending on the scale of the initial change itself. But the impacts of a utility's actions mean little, unless they are placed in the context of impacts of other changes, such as the prices and availability of other sources of energy, general economic conditions (boom or recession) and the changing values of our society (for example, more women in the labour force, conservation for its own sake, or attitudes towards redistribution of wealth). For example, we may find that a certain change in general economic conditions on society than doubling the rates for electricity, or that a changing outlook that leads many more women to enter the labour force affects the general level of employment much much more than some dislocation from higher prices for electricity. Of course, the purpose of impact studies is not to justify higher prices for electricity nor to belittle their effects but rather to measure and appraise changes in the price of power in the light of other potential changes taking place in Ontario.

To this, we can add the kind of impacts we are anticipating (always remembering that other higher-order and unintended impacts will probably be uncovered in the course of a study). These can be classed as Functional, Customer, and Commodity

impacts. A matrix can now be drawn up to display the assessed effects of (say) a specific change in electricity rates on the economic growth rate in Ontario, as well as the other functional impacts chosen for study. A sample matrix form is shown below.

One can assess the effect of one impact on another by applying the information in the matrix. For example, a change in electricity rates may more severely affect farm customers than industrial customers, but a change in general economic conditions favouring food producers may offset this. This is usually called a cross-impact matrix. It is an accepted tool of impact analysis, and one commonly used by the Environmental Protection Agency in the U.S. It is given here as an example of another useful tool for improving future impact studies.

F. ENVIRONMENTAL EFFECTS

Environmental effects considered in this section are effects on air, land, plant and animal life, and water quality.

In brief, most of those depend on the impact of pricing on the use of of electricity. There are two causal factors here: increases in the rate level, and changes in the rate structure.

Customer sensitivity to price increases is expected to cause the rate of growth in the demand for electricity to decline from the presently projected levels. Under average-cost pricing, the lost growth would correspond to some fossil and some nuclear plant, roughly in the same proportion as our present demands on baseline, intermediate, and peaking-plant. The environmental effects of slower growth, then, would be less air pollution from the forgone fossil generation, and less overheated water from the forgone nuclear generation. The higher-order effects on land, plants, and wildlife, as well as on municipal governments and townships, those uncovered in earlier site-impact studies of Ontario Hydro (on the Bruce Nuclear Power Development, for instance).

A move to the rate structure of Scenario B would have more marked effects on the environment, since the rate structure would change so that increased (or 'marginal') use would cost more than it does now. The rewards for conservation would be correspondingly greater. Although the extent of the effect cannot be estimated with precision, the direction would be towards more conservation and hence forgone consumption, leading to a better environmental impact than one would obtain from merely increasing prices under the current system. Time-of-day pricing would flatten the load curve eventually, and in the load remaining after conservational effects had worked through, nuclear plants would account for a larger share than they do now, and fossil for a smaller one. That might change the balance of the pollutants, leading to more overheated water (relatively speaking) and less dirty air.

A further discussion of environmental effects is contained in Section IV of Volume VI, "Pricing for Environmental Protection".

G. COMPARISON OF IMPACT STUDIES

This section will briefly compare Ontario Hydro's impact study with others carried out by two American utilities and two research agencies. These are listed below:

1. Bonneville Power Administration, *Impact Study*, November 1973.
2. Tennessee Valley Authority, *Environmental Statement*, August, 1975.
3. Rand Corporation, *Impact of Electricity Price Increases on Income Groups*, prepared for the California State Assembly, November 1972 and March 1973.
4. Federal Energy Administration, Costing and Pricing Study, Impact Section.

1. Functional Impact Matrix

	Conservation of energy	The ec. growth rate	Pollution	Life Styles	Balance of payments	Employment	Ontario's position in Canada
Electricity Rate Change							
Electricity Plant Location							
Growth of electrical energy output							
Growth of Peak Output							
Other Energy Prices							
General Economic Conditions							
Changes in Society's values							

2. Customer Impact Matrix

	Residential	Commercial	Industrial	Small Industry	Large Industry	Farm	Low Income	High Income	Municipality
Electricity Rate Change									
Electricity Plant Location									
Growth of Electrical Energy Putput									
Growth of Peak Output									
Other Energy Prices									
General Economic Conditions									
Changes in Society's Values									

3. Selective Commodity Impact Matrix

	Food	Automobiles	Fertilizer	Housing	Chemicals	New Commodities-eg. electric car
Electricity Rate Change						
Electricity Plant Location						
Growth of Peak Output						
Other Energy Prices						
General Economic Conditions						
Changes in Society's Values						

The discussion is not intended as a critical analysis of these studies. Instead it will compare the approaches the various task teams took, and the scope of their reports, to Ontario Hydro's impact study.

1. The Bonneville Power Administration (BPA) Impact Study

In the early 70s, the Bonneville Power Administration decided to appoint a task team to "study the possible environmental effects of a proposed BPA rate increase to be effective December 20, 1974". The study was originated to answer two main questions:

1. How do rate changes affect patterns of electricity consumption? and
2. If there is an effect on consumption patterns, what are the effects on the "environment"?

The report, 180 pages in length, was published in November 1973.

The task team knew the rate increase would be between 20 and 30 per cent. It therefore assumed a wholesale rate increase of 25 per cent, and studied what effects this one-step increase would have in the short and (more especially) in the long run. (to 1990). This contrasts with Ontario Hydro's impact study, which primarily examines the effects at two future dates (1978 and 1983) of a series of rate increases which may increase retail rates by as much as 200 per cent by 1983.

The main thrust of the BPA study was towards calculating price elasticities for the region it serves, the Pacific Northwest of the United States. The team looked at various studies on the price elasticity of electricity, but decided to develop its own estimate because of its particular situation. For example, its electrical rates have traditionally been half national average, and the local gas-distribution system was limited (thus perhaps affecting cross-elasticities).

Price elasticities were arrived at through cross-sectional regression analysis of each of three customer classes: residential, commerical, and industrial. For the residential class, the study was based on saturation elasticities of various electric appliances. Other variables included in the regression were income, gas prices, and degree days.[13]

These appliance elasticities were used to support the study's estimate of elasticity for average residential use (which was -0.59). The elasticities for commercial and industrial demand were based on limited aggregate data of questionable usefulness. For example, the commercial demand elasticity (-1.07) was based on 75 observations of publicly owned utilities in the Pacific Northwest, with the only two variables considered being price and temperature. (These were also the only two independent variables used for residential elasticity functions.) The task team assumed a 15-year lag for full impact, and assigned a value of -0.8 for overall price elasticity.

For their study, the BPA task force made a number of assumptions and forecasts about "all" other relevant factors for estimating energy consumption as far as 1990. They then forecast the use of energy (electricity, oil, and gas) with and without wholesale electricity rates. Note that the study translated a wholesale rate increase of 25 per cent to a 10-per-cent increase at the retail level, since their wholesale cost of power represents, on average, only 40 per cent of the distributor's costs. Thus the rate increase studied was quite small compared to the one Ontario Hydro studied. BPA estimated that because of the increase it would need one less 1,000-megawatt generating-station by 1990. The study mentioned social and economic effects only briefly.

About 50 pages of the report discuss the alternative rate structures. Some of the topics were marginal costs, a dual-rate system, peak pricing, good-conduct rates, offset credits, and special purpose rates. The discussion on each of these rates is descriptive and narrative, and provides only suggestions of the possible costs or benefits of such rates.

To assessing the effect of rate increases on its customers, the BPA study devoted only a few pages. BPA's customers are distributors. An analysis of their financial positions in 1972 suggested which ones needed a revenue increase, with and without an assumed increase of 25 per cent in the cost of power. Then it analysed 87 utilities' needs for retail revenue increases, and considered how many residential customers would face what percentage increase. As for direct industrials, the report notes that electricity costs would still amount to less than two per cent of shipment value, and that the impact would thus be minimal. A brief comment was also given on the impact of BPA's proposal to make half the industrial load interruptible for two hours at most.

In summary, the BPA study focused on the effect of a wholesale rate increase of 25 per cent *across the board* on energy use, and on some of the environmental effects of such a change. The Ontario Hydro impact study was quite different in scope, in that it concentrated on the social and economic effects that far-reaching changes in rate *levels* and *structures* would have on the end user.

The Impact Committee at Ontario Hydro did not develop demand elasticities, because that task was assigned to another team of the Costing and Pricing Study. Since these elasticity estimates were not available at the time of the study, other approaches were used. Case studies in which various end-use customters were interviewed suggested how they might react to changes in rate levels. The case study is also a good method for studying the effects of various changes in rate structures, something for which aggregate elasticities can hardly be useful. Aggregate sectoral studies also used various scenarios (with different assumptions) to provide further insights. Even if elasticity estimates had been available, their usefulness for the impact study would have been limited, since the proposed rate increases are very large and thus differ from anything one could incorporate in models built on past behaviour and relationships (such as regression analysis).

Nevertheless, the Impact Committee developed a sensitivity analysis based on various real marginal price increases,[14] and assuming a range of possible price elasticities for each customer class (residential, commercial, and industrial). The Committee also developed a Delphi forecast of prices for substitute fuels, to help determine what the actual fuel price relationships would be. Cross-elasticity measures were not directly deployed in the analysis, since the fuel price forecast did not foresee any significant change in present relationships over the stretch of time studied.

Ontario Hydro's impact study assessed possible harmful effects of rate increases, as well as beneficial ones. The BPA study concentrated on the positive effects on the environments.

[13]The regression models sometimes produced questionable estimates of elasticity for certain variables. For example, a negative coefficient was associated with income.

[14]The BPA study applied an increase of 10 per cent in retail rate levels in its calculations. This increase seems to be a nominal one, as opposed to a real price increase. Price elasticities should normally be used with real increases, which discount inflation.

Hydro's study thus concentrated much more on the end user and the effects on him. For example, it made estimates of what percentage of its income a family might spend on electricity.

Moreover, Hydro used rate scenarios to provide some analytical framework in which to study various social and economic impacts. This enabled the task team to arrive at some tentative conclusions about the effects of marginal-cost pricing, whereas the BPA study offers general comments.

Some other areas which the BPA study did not deal with are the effect of changes in rate levels on inflation and the reaction of interested parties. In short, the BPA study had limited scope, and concentrated on the demand elasticity of electricity.

2. The Environmental Statement of the Tennessee Valley Authority

In August 1975, the Tennessee Valley Authority (TVA) published its *Environmental Statement*. As originally envisioned, the study and any resulting impact statement was to have been structured to answer two questions:

1. How would various rate designs and charges affect the use of electricity? and
2. Once the effects on power use were known, what would be the total environmental effects, both those related to construction and operation of generating and transmission capacity and those related to fuel substitution, changes in industrial use patterns, and other general effects?

Hence the questions it sought to answer were very similar to those raised in the Bonneville impact study. It was to concentrate on price elasticity and its effects on the environment. Moreover, the TVA meant it to be a generic study of rate levels and structures, and to avoid repeating such studies for every rate change.

However, the TVA report is very different from the Bonneville one. As was explained in the previous section, the Bonneville study developed certain models and assumptions to arrive at some very specific estimates of price elasticities for three classes of customers. In contrast, the TVA study concludes that, because of the numerous factors involved, too many questionable assumptions would be required to develop a sound estimate of elasticity.

The main problem the TVA study cited was the energy substitution effect. The substitution effect is inherently included in any price elasticity estimate, but the TVA team found it impossible to make sound assumptions about the availability and price of substitute fuels. They cited the uncertain future in substitute fuels, and the break from historical trends, as reasons for discounting the validity of many price elasticity studies. In comparison, Ontario Hydro made use of a futures research approach to forecast such things as the price and supply of gas and oil. The delphi forecasting technique, employing outside experts, was used for this particular task. (In a delphi forecast, a panel of experts give their own subjective, individual forecasts, and these are then worked into a consensus. Reaching this consensus may take three or four rounds of questionnaires.)

The TVA study also seriously questioned the validity of some price elasticity estimates for the commercial and industrial markets that various American agencies had made. For the industrial sector, TVA based its criticism on interviews of firms (the study does not mention their number or scope). These led the TVA team to doubt whether the industrial sector could substantially react to any rate change, and thus to question the high elasticities obtained from various models. This method seems to resemble one part of the Ontario Hydro Impact Study, which used interviews (with specific industrial and commercial firms) to reach insights into the effects of future rate changes.

The study briefly discussed the effects on industrial growth which the team studied by using a computer simulation model. The study only reports on the results, and does not discuss the methodology or data used. It concludes that the effect of modest rate changes on industrial location decisions would be minimal. It does not mention the possible effects on such things as competition, plant expansion, or product lines. Again, the scope of the Ontario Hydro study was much broader, in that it attempted to gain some knowledge about all relevant effects on the industrial sector.

The TVA study also considered alternative rate structures, using much the same methods as the Bonneville Power Administration. That is, the discussion of various rates (such as LRIC, dual rates, peak versus off-peak) is descriptive and narrative. Again, this contrasts with Hydro's study, which made use of various scenarios. In fact, the TVA study does not deal with the magnitude of the future increases in rate *levels* which it is supposed to consider.

In general, the team concluded that various rate structures would have little effect on how customers used power. Finally, the report stated that the "TVA studies indicate that the effect of changes in electric rates on the environment is remote and not possible to trace with any degree of certainty".

The Bonneville and TVA studies seem to be at opposite ends of a spectrum of approaches to an impact study. The first concentrates on price elasticities and bases its conclusions on these estimates as the single tool of impact analysis. The TVA study, on the other hand, rejects the whole approach, and concludes that the impacts cannot be traced. Ontario Hydro's study, in comparison, used such tools as futures research, technology assessment, case studies, and sensitivity analysis.

3. Rand Studies on "The Impact of Electricity Price Increases on Income Groups"

In November 1972, the Rand Corporation published a report titled *The Impact of Electricity Price Increases on Income Groups: Western United States and California*. This was intended as an "aid to policy makers and analysts concerned with energy policy in California", and dealt with the varied effects of increases in the price of electricity on various income groups. Thus the study focuses on the effects of changes in rate levels on residential customers only, and does not concern itself with effects on other classes of customers or of changes in rate structures.

The data for the study were obtained from a survey carried out in 1960 and 1961 by the Bureau of Labour Statistics, which provided spending by income groups on various items such as energy and appliances. These data enabled the Rand task team to make some analysis of how changes in rate levels affected various classes of residential customers. The Ontario Hydro study, in contrast, did not have similar trustworthy information available, and could thus only analyse the effects of rate changes on representative and low-income households.[15] The Rand study found that households with an annual income of less than $3,000 represented 17 per cent of the population but consumed only six per cent of the electricity.

[15] See the case studies on a representative household and the paper on low-income users.

The Rand report then proceeded to estimate the short-run and long-run effects. In the short term, they estimated a mean price elasticity of -0.25 for price increases of 50 per cent and 100 per cent price increases (the report does not explain how they reached that estimate). For the long run, they developed estimates of price elasticities for various income groups. The method employed to obtain such separate estimates is explained below:

1. Estimate for a single area (Los Angeles) the saturation of electric and gas-consuming devices held by households in different income groups (based on a 1970 survey by the *Los Angeles Times).*
2. Divide the appliances into luxuries and necessities.
3. Estimate each group's use of electricity by multiplying saturation levels and average consumption per device in kilowatt-hours (they assumed a constant appliance intensity of use for all income groups).
4. Estimate drastic and reasonable withdrawals of electrical items for each group, and the corresponding elasticities implied.
5. Choose elasticities close enough to the implied values for the aggregate elasticity to equal the average of the elasticities found by two other independent researchers, Wilson and Anderson.

Even given the quality of data the Rand team had available, one can question their methodology. For example, assuming a constant intensity of appliance use for all income groups is questionable, low-income households might very well lead a more home-centred life and therefore use their appliances more heavily. The Rand report itself mentions this (with supporting facts) in another section, when it defends its rather arbitrary division of appliances into luxuries and necessities.

The study also confuses time periods. Spending on energy and appliances by income group in 1960-61 was combined with appliance saturation levels for 1970. Moreover, one might venture to doubt whether data eleven years old were a particularly good basis for forecasting future effects. In our case, the oil price increases of 1973 provide a breaking-point after which one might expect energy use to change rapidly, and in such a way that earlier data would provide a poor basis for modelling the future.

The Rand study differs from the BPA and TVA ones in using some elasticity estimates provided by two other agencies. For example, it uses the average of Wilson's price elasticities and Anderson's to obtain an aggregate estimate, even though the two models are not strictly comparable.

Finally, the study briefly mentions the implications of its findings for policy. The general conclusion is that low-income groups would suffer most, and that if they were exempted from proposed rate increases, the effects on total residential use and revenues would be slight.

Because most of the study was based on 1960-61 data, the Rand Corporation published another report in March 1973 which was based on 1970-71 data. This, however, was to focus on Los Angeles as a case study.

For this study, the task team first developed a model which (in essence) related a household's energy use to its income and the number of members, and to the price. The model suggests that price elasticity increases with income, and higher-income users exhibit greater seasonal variations in their consumption patterns. In fact, the results confirmed those of the previous study in such matters as how many kilowatt-hours a certain income group would use. The report does not, however, discuss the statistical distribution of use within various income groups, and therefore does not answer the crucial question of how many low-income households use more than the average number of kilowatt-hours; this question is extremely important for dealing with such proposals as life-line rates.

As a whole, the Rand studies seem to be fairly good, mainly because of the superior data employed. Throughout the studies, various cross-checks were made to measure the validity of the results, and many assumptions are well supported by data. Nevertheless, one can still question the methodology for (example, dividing appliances into luxuries and necessities) and some of the assumptions.

4. Federal Energy Administration Study

In August 1975, the U.S. Federal Energy Administration published a study entitled *A Study of Electric Utility Industry Demand, Costs and Rates.* The report stated that current rate structures did not charge customers in accordance with their responsibility for additions to plant capacity, and that off-peak users were being overcharged.

Much of the study was devoted to load forecasting, which was done by having a computer aggregate the individual load curves for each main use. Some of these projections illustrated the effects of diurnal (or peak versus off-peak) and seasonal peak pricing on the use of electricity and on summer and winter peaks. This section (Chapter V, Section D) essentially constituted the only impact study in the report.

First, the report looked at how heating storage might affect system load curves (the writers believed storage systems could provide large savings for customers by 1995). The study examined the potential effect of various saturation levels of heating storage on a certain utility's load factor. For example, one utility might improve its load factor by six per cent with 30-per-cent saturation. (Ontario Hydro's cost-benefit study of time-of-day pricing for residential customers considers the growth of storage heating.)

Then the report estimates the effect of diurnal and seasonal pricing on storage saturation and on three crucial elements of a load curve: annual kilowatt-hours, summer peak kilowatt-hours, and the winter peak kilowatts. The study analyses three scenarios:

a. A system with summer peak seasonal rates for all customers, and diurnal rates for large industrial customers only.
b. The same as above, except that diurnal rates are also applied to residential customers.
c. The same as (B) except that the system has a winter peak.

The analysis of the effects of these rate scenarios (note that no specific values were assigned to the rates) had two separate aspects: first, to estimate how each customer's use of kilowatts and kilowatt-hours would change (reflecting both technological and behavioural changes); and second, to estimate the effect on saturation levels.

The report then draws these conclusions from the results:

1. Rate structure management may affect peak demand more than it affects use of kilowatt-hours (a decrease in kWh consumption of 3.3 per cent, as against a decrease in peak demand under Scenario A).

2. Simple seasonal pricing-structures may bring about a considerable portion of the potential benefits from more elaborate rate structures, (reduction in peak demand of 8.7 per cent under Scenario A, as against a reduction of 11.0 per cent under Scenario B, which would require spending much more on metering).

3. The benefit from rate structure changes may vary greatly from system to system. Peak demand was reduced by 20.7 per cent under Scenario C where the system had a winter peak. The saturation is more elastic for electric space heating than for air-conditioning (because alternative fuels are available), and therefore the rate structures are more effective.

ADDENDUM: PERSONAL DISPOSABLE INCOME IN CANADA

Personal Disposable Income (PDI) in Canada increased at an increasing rate from 1971 to 1974. Ontario has had one of the slowest growth rates, while Saskatchewan and Alberta have had two of the fastest. Although Ontario had the highest PDI in 1974, the high-growth provinces may exceed Ontario by the end of this year. Alberta only needed an increase of 13.9 per cent in 1975 to meet Ontario's estimate. Its annual increase has averaged 16.8 per cent for the past three years. See accompanying Table for source and supporting information.

PERSONAL DISPOSIBLE INCOME PER PERSON

	1971		1972		1973		1974		1975		1976
	$ Millions	%	$ Millions	%	$ Millions	%	$ Millions	%	$ Millions	%	$ Millions
Newfoundland	1,881	13.0	2,126	12.9	2,401	16.7	2,803	-	-	-	-
P.E.I.	1,848	17.8	2,177	19.0	2,591	7.5	2,786	-	-	-	-
Nova Scotia	2,224	12.9	2,511	13.2	2,843	14.1	3,245	-	-	-	-
New Brunswick	2,117	12.6	2,384	10.3	2,629	16.6	3,066	-	-	-	-
Quebec	2,480	12.1	2,779	12.1	3,114	19.9	3,589	-	-	-	-
Ontario	3,176	11.4	3,539	11.0	3,929	12.1	4,405	13.0	4,974	12.4	5,598*
Manitoba	2,644	12.1	2,968	17.7	3,493	12.7	3,937	-	-	-	-
Saskatchewan	2,374	8.1	2,567	32.1	3,390	18.0	3,999	-	-	-	-
Alberta	2,780	11.0	3,085	17.3	3,618	13.8	4,116	19.4	4,914**	-	-
B.C.	2,978	12.0	3,334	13.3	3,779	12.9	4,267	-	-	-	-
Yukon & N.W.T.	2,302	14.5	2,636	8.6	2,862	20.8	3,456	-	-	-	-
Canada	2,769	11.7	3,093	13.2	3,501	13.7	3,980	-	-	-	-

SOURCE: User Advisory Service, Toronto. Statistics Canada
*From the 1976 Ontario Budget, assumes 80% of Personal Income is Personal Disposible Income, 1976 is an estimate
**From the Alberta Economic Accounts 1975, Alberta Government Bureau of Statistics

II AN IMPACT ASSESSMENT OF ONTARIO HYDRO ELECTRICITY RATE LEVEL AND STRUCTURE CHANGES

Final Report
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This study is unique in that it represents a conscious effort to apply Technology Assessment methods to the study of rate structure impacts. Credit for recognizing the need for a comprehensive impact assessment is due to Mo Reinbergs, Impact Study Coordinator. Mr. Reinbergs, instrumental in the creation and planning of this study, has provided day-to-day coordination with other impact study projects conducted internally by Ontario Hydro.

The willing assistance of many organizations was necessary for the performance of this assessment. To the representatives of the various interest groups and case study subjects who were interviewed, and who provided material assistance in the form of data and factual information, we extend sincere thanks. We have endeavored to acknowledge these contributions wherever they have occurred. Technical information and criticism were received from many others, notably Alex Juchymenko of Ontario Hydro and Dr. Jack A. Donnan of the Ontario Ministry of the Environment.

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I. INTRODUCTION

During the past four decades the cost of providing electric utility service has increased at unprecedented rates. Costs have been driven up by high general inflation in North America and by rapid increases in world fuel prices. As a result of these cost increases, utilities are faced with new problems in costing and pricing. For example, there has been a renewal of interest in marginal cost-based pricing, particularly in the form of long run incremental cost (LRIC) pricing. As conservation has become a vital issue, utility rate-makers are more concerned than ever that their customers receive the "right" price signals.

Ontario Hydro is now engaged in a major study of costing methods, pricing alternatives, price elasticities, and socio-economic impacts of electricity rate change. The impact study portion of this program endeavors to examine the probable effects on the customer, society, the economy, and the environment of significant changes in utility rate structure and revenue requirements. This document describes the results of one portion of Ontario Hydro's impact study. In September 1975, Ontario Hydro engaged Hittman Associates, Inc. (HAI) to design and perform an analysis of the impacts of electricity rate change in Ontario. In this analysis, Hittman Associates has applied its experience in the conduct of technology assessments.*

The approach taken in this assessment involves four basic steps.

First, two electricity rate scenarios were constructed to embody key pricing concepts being considered by Ontario Hydro.

Second, these scenarios were presented to major institutions interested in utility rate change in Ontario (but outside the actual rate-making and approval process). These various interest parties were questioned in detail as to their positions towards the rate proposals.

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* *The phrase "technology assessment" (TA) has come to mean the systematic study of the effects on society that may occur when a technology is introduced, extended, or modified, with special emphasis on impacts that are unintended, indirect, and delayed, including impacts on the social, economic, legal, environmental, political, and other aspects of society. The study, because of its limited scope, is best termed a mini-TA. It covers all the elements that would be part of a complete TA, but only in a preliminary manner.*

Third , a series of case studies was conducted. These case studies were selected from industrial, commercial, institutional, and residential customers of the Ontario electric utility system. A municipal utility, which buys power wholesale from Ontario Hydro, was also included. Intensive interviews were held with management and technical representatives of each of the case study subjects, to determine how the two rate scenarios would impact their particular situations, as well as what secondary and higher order reactions might occur.

Fourth, impact models were constructed to symbolize the various feasible actions and reactions (in response to rate sturcture and level changes) identified during this study. These models indicate the technical and socioeconomic phenomena surrounding electricity rate changes in the cases studied. They are designed as a starting point, to be improved upon by (and integrated with) Ontario Hydro's current internal impact study program and future impact work.

Ensuing chapters describe the results of each of the four steps in our study approach. The description of the two rate scenarios defines and bounds the subject of the investigation. The position study places the scenarios in their political perspectives, showing the divergent views of rate change taken by strong interest groups. A case study technique has been used in an effort to provide depth not possible on a larger scale. The impact models and their discussion, drawing from both the position study and the case analyses to provide a useful consolidation of the study results, appear in the following summary chapter.

II. SUMMARY

The approach taken in this program's position and case studies has been purposely open ended, in the sense that their objectives include the raising of new questions, uncertainties, and programmatic issues concerning rate change. This study is, then, unlike most research studies in that it is not the solution to a problem already seen. To integrate the variety of questions, uncertainties, and issues identified, two "impact models" are discussed.* Finally, some general observations are made of the overall impact trends discerned in this work.

One caveat is required:

> Any general observations must be carefully qualified. They are based on the results of a limited number of case studies, and not on an exhaustive analysis of all possible cases.

A. Rate Change Impact Models

The purpose of developing impact models from the position study and case analyses is to visually summarize the chain of events following designated rate changes. These events encompass the basic social, political, and economic phenomena brought to light through this study effort. Moreover, through the use of such models, the correspondencies and interactions among the individual chains appear, and certain generalized trends become evident.

1. Increased Bulk Power Revenue Impacts (Scenario A)

a. Political Responses. The major events following a doubling of bulk power revenues by 1978 are shown in Figure II-1. Some of these, revealed by the position study, are political in nature. Rising rates will cause vigorous opposition from industry and consumer groups such as AMPCO and the Consumers Association of Canada, as well as from individual industries and consumers. A representative of Lake Ontario Steel, for instance, stated that the firm would actively intervene in electricity rate increases, both

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The assertions contained in the impact models (and their associated summary discussions) are derived from the individual case and position studies contained elsewhere in this report. Greater detail can therefore be obtained by referring back to the specific case and position study analyses.

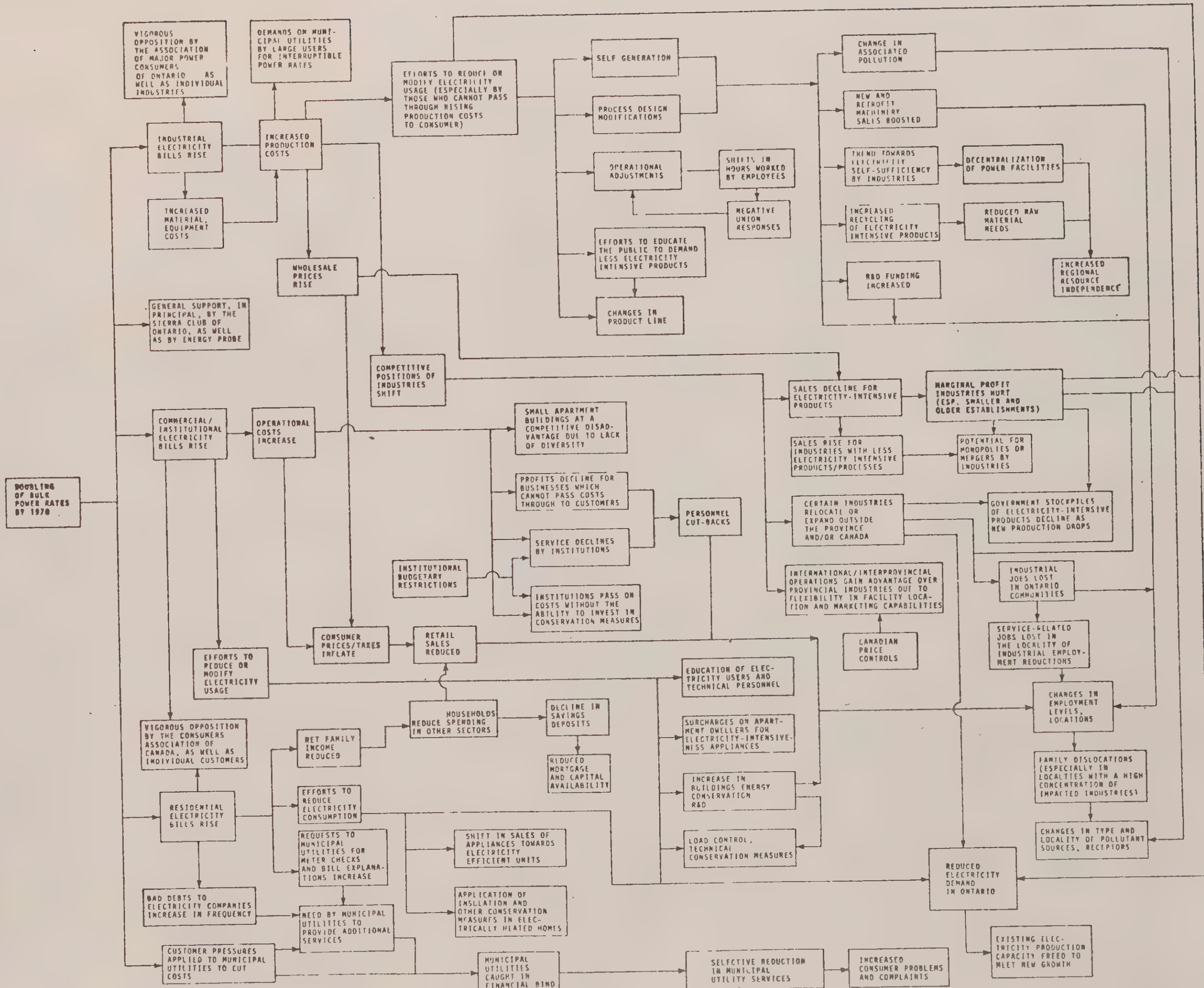

Figure II-1. Impact Model, Doubling of Bulk Power Revenues by 1978

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through AMPCO and as an individual industry. On the other hand, groups such as the Sierra Club of Ontario and Energy Probe will likely provide support for such increases, largely due to the resultant conservation of electricity.

b. Industrial Sector. Rate increases in the industrial sector will have the immediate result of increasing production costs, which, in turn, will cause wholesale prices to rise (when possible), and a shifting in the competitive positions of certain industries. A representative of Canadian Carborundum felt that the very electricity-intensive abrasives industry would be affected in this way, with the price of synthetic abrasives rising with electricity costs, and the most electricity-efficient operations gaining a competitive edge. At the same time, rising synthetic abrasives costs would cause a reduction in sales (with a number of Ontario abrasives firms closing or relocating outside Ontario), while alternatives to using synthetic abrasives (such as the use of natural abrasives, or the outright elimination of grinding operations) would become more prevalent.*

International and interprovincial companies will, in general, gain an advantage over intraprovincial industries if electricity costs rise faster in Ontario than is experienced elsewhere. This is due to those firms' apparent flexibility in relocating existing or planned production capacity to areas with lower electricity costs. Such a move can be complicated by an industry's need to be near its major market area. In the case of Lake Ontario Cement, for example, a relocation of planned grinding facilities is a possibility, but increased transportation costs would probably preempt the move. However, in the case of Canadian Carborundum, the firm's international nature allows it the very viable option of moving electric furnace capacity to another facility. The company indicates that it has already contracted for electricity in the State of New York at much lower rates than those projected for Ontario. Secondly, the Canadian Anti-Inflation Program would tend not only to encourage this relocation, but also would aid firms which export since foreign (primarily U.S.) prices are not controlled. Intraprovincial establishments, on the other hand, would be more likely to remain and face the higher electricity costs and price controls. As a result, electricity-intensive intraprovincial firms may be placed in a disadvantageous position as electricity production costs rise.

One of the other case industries (The Ontario Paper Company) provides a ready example, as it would consider the elimination of grinding operations.

Industrial wholesale prices rise, not only because of increasing in-house (electricity) production costs, but also if manufacturing inputs such as raw materials or replacement equipment increase in price. Lake Ontario Steel, for example, expects to pay more for its scrap iron feedstock because the scrap is run through an electrically-driven shredder before delivery to the firm. Rising electricity costs, then, may not only increase plant production costs, but also the cost of inputs to the production process.

Rising electricity rates will create a greater interest by industry in reducing or modifying present electricity usage. Self-generation of electricity and changes in process design for greater electricity-efficiency were cited as the largest steps an industry can take in order to reduce electricity costs. Both require significant capital investment, however, and, in many cases, are not cost-effective. The Ontario Paper Company provided an example of a firm in which both of these options might be seriously considered. The self-generation plant would be a combination solid waste recycling-incinerator plant fueled by trash from local communities, while a process change would replace the firm's electricity-intensive grinding operations with a more electricity-efficient paper recycling process. Ontario Paper also has the more conventional option of increasing electricity self-generation by running process steam through turbines before use. All of these steps would (as displayed in Figure II-1) change pollutant levels at the plant, boost sales in other (supply) sectors, and make the firm more electricity self-sufficient.

Both the recycling of paper for pulp and the trash recycling aspect of the Ontario Paper Company's proposed self-generation plant would have the added attribute of reducing raw material consumption. The newspaper recycling step would directly reduce Ontario Paper's demand for timber. The trash recycling effort would provide an additional source of raw materials, possibly reducing dependence on other regions, Provinces, or nations for virgin materials. Overall, recycling efforts which result from a need to reduce purchased electricity will augment regional resource independence.

Other industrial measures for reducing or modifying electricity consumption noted in Figure II-1 include: operational adjustments, efforts to educate consumers to use less electricity-intensive products, and changes in product lines. All industries interviewed already operate continuously, and operational adjustments for load management appeared minimal. Certain competitors of Canadian Carborundum, however, presently operate only a five day week, and a shift to

continuous operation could help these firms reduce electricity product costs (through a more even load distribution). It was expected that attempts to switch employees to weekend and holiday shifts could meet substantial opposition from labor unions, and it may be difficult for industries to make such operational changes.

During interviews with Lake Ontario Cement, it was found that it is possible, through education of consumers, to substitute less electricity-intensive grades of cement for presently marketed grades. Evidently, many customers believe that a higher "blaine value" in a cement means a higher quality product. In fact, a higher blaine value requires increased cement grinding (a very costly and electricity-intensive step), but does not change the structural performance of the product. Through such educational efforts (and resultant change in product demand), industries may be able to reduce electricity usage and product costs.

c. Commercial/Institutional Sector. Rising electricity rates to commercial and institutional establishments will, in general, mean a rise in operational costs. At the Marks and Spencer retail store, it was felt that rising electricity costs would result in the following impacts (depending on future market conditions): (1) rising prices, (2) a decline in profits, (3) a reduction in personnel, or (4) some combination of the above. Though not considered as important as operational cost rises, it was mentioned that consumer price increases would be compounded in some cases by rising wholesale prices (as a result of electricity costs to producers).

Competitive positions of commercial establishments can also be affected as electricity rate increase. In the case of the Cadillac-Fairview apartment building, it was noted that smaller bulk-metered apartment buildings would be at a disadvantage. Their fewer number of residents causes them, in general, to have less diversity in users and, therefore, lower operational load factors. A doubling in peak demand charges would, then, affect smaller bulk-metered apartment buildings more than would be the case for a larger building.

In the case of a Toronto office building, it was pointed out that the Prudential Assurance Building profit margin could be reduced if electricity rates were to rise, due to its relatively high vacancy rate. Competition from more prestigous office buildings requires the Prudential building's basic rental charges to be held low. Rising electricity costs are passed on easily through an "escalator clause" in existing tenant contracts. New residents will have a similar "base" charge (due to a need to be competitive)

without the fuel adjustment paid by existing tenants. Hence, the office building management will not likely be able to pass rising electricity costs through to tenants as readily as will the fully occupied buildings. Clearly, as seen for both the apartment and office building cases, the competitive positions of commercial establishments can be noticeably affected by rising electricity rates.

Public institutions will also face rising operational costs. In the case of Toronto General Hospital, it was stated that, because of government funding restrictions, the hospital would probably be unable to afford the initial capital investment required for any major steps toward electricity conservation. Toronto General might instead have to cut back on service (via personnel layoffs) and/or raise charges to the public (either through taxes or insurance premiums).

Commercial establishments will have certain options available to modify or reduce purchased electricity usage. In the case of the Cadillac-Fairview apartment building, the management has begun to take numerous electricity conservation measures, including the computer simulation of building energy use to determine areas of energy waste and seminars to educate apartment building engineers. Cadillac-Fairview is also considering the implementation of surcharges on electricity-intensive appliances (such as air conditioners). The Marks and Spencer retail store already has taken steps to reduce lighting and could take some measures to improve the building's load factor, but is restricted in many ways by the overriding need to provide maximum service to the customer. The Prudential Assurance office building might consider efforts to educate tenants in energy conservation, but would also be restricted by the need to provide premium service. Therefore, commercial establishments have numerous operational, educational, and technical options available to reduce electricity consumption as electricity costs rise, but will also have to consider the paramount issue of providing competitive customer service.

d. Residential Sector. As residential electricity rates rise, a greater proportion of family income will be required to pay electricity bills, causing reduced spending in other sectors and efforts to conserve electricity. Decreased net family income may reduce retail purchases (which will be further aggravated by any electricity-related retail price increases), but the primary impact may be a decrease in Ontario families' savings. At the same time, rising electricity costs will elicit complaints and questions to municipal utilities from homeowners, while likely increasing the level of bad debts to the utility.

Efforts to reduce residential electricity consumption will center largely around new sales of appliances and heating conservation measures in electrically-heated buildings. As electricity costs increase, homeowners become more aware of the operational costs of electrical appliances (versus only initial cost), and sales of electrically-inefficient appliances will gradually decline. Middle and upper income owners of electrically-heated homes will also be more likely to invest in energy conservation measures such as increased insulation and storm doors and windows.

e. Municipal Utilities. As major retailers of electricity in Ontario, municipal utilities will face much of the customer reaction to bulk electricity rate increases. It was pointed out by Mississauga Hydro that rising rates will elicit consumer complaints and requests, a rising frequency of bad debts on electricity bills, and consumer pressures for municipal utilities to cut their "retail" prices. As a result, municipal utilities will likely be faced with the quandry of having to provide more customer services than ever before, while trying to reduce costs.

The municipal utilities' reaction to rising bulk power rates will be to (1) attempt to dissassociate themselves from electricity rate increases, and (2) selectively cut-back on customer service expenditures. However, the municipal utilities charges represent only a small part of a customer's total bill. A municipal utility service cut-back, then, would only have a slight impact on customer billing (but would increase customer problems), and thus service cut-backs, while plausible, seem unlikely.

2. Pricing Policy Changes (Scenario B)

Figure II-2 symbolizes events and interactions following the hypothetical adoption of a number of basic electricity pricing policy changes, all designed to provide more cost-representative price signals to Ontario consumers. It should be noted that, in the interviews supporting this model, the following pricing policy changes were presented in "Scenario B" as combined with a bulk power revenue increase in order to present a realistic scenario to interest groups and case study subjects. Here, for simplicity (and to avoid repetition), the impacts of pricing policy changes are discussed independent of bulk power revenue change impacts (discussed in Part 1).

a. Shift in Demand/Energy Revenue Split. In early 1975, Ontario Hydro wholesale electricity billing was more demand-oriented than energy-oriented, with the demand to energy revenue

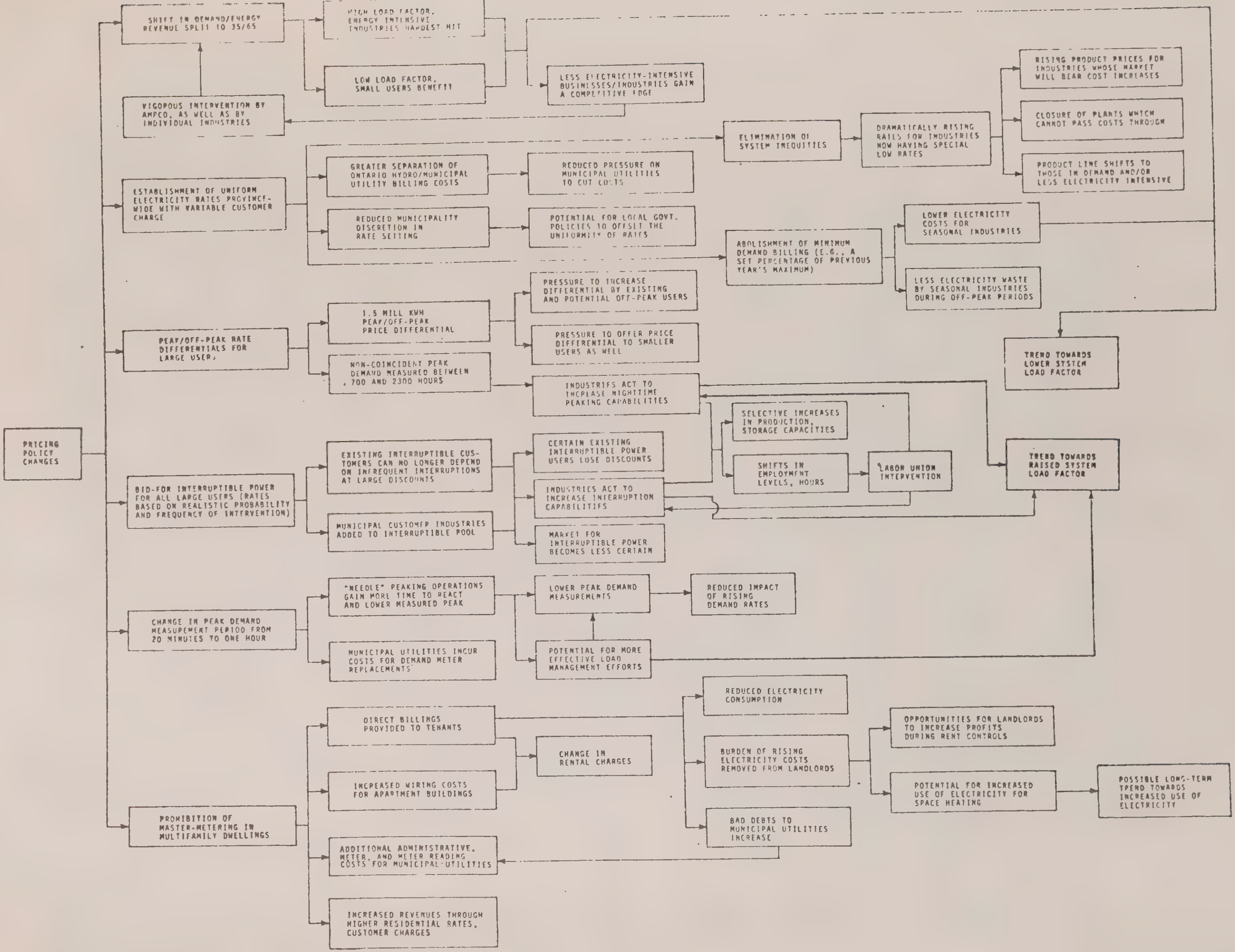

Figure II-2. Impact Model, Pricing Policy Changes

ratio being 65/35.* If this ratio were to be reversed, then energy use (KWH) would gain a relatively greater importance than at present, while maintaining low demand peaks (KW) would be of lesser importance. As a result, very electricity-intensive consumers would experience price increases,** while smaller electricity users would benefit. For instance, in the case of the Cadillac-Fairview apartment building, it was pointed out that, under Scenario B, all-electric buildings would be hurt competitively by relatively high electricity consumption levels, while smaller buildings (which now pay more for their characteristically low load factors) would benefit. Therefore, less electricity-intensive establishments could gain an edge over competitors in operational costs as a result of a shift in the demand/energy ratio.

The reduced emphasis of this pricing policy on maintaining a low peak demand (KW) would lessen Ontario electricity consumers' incentive to achieve a high load factor. It is likely that high load factors would become less important than, say, a cement firm's need to maximize production at peak demand periods, or a retail store's providing of services at the most convenient time for customers. Reduced accentuation on the demand portion of electricity bills, though not an "incentive" to reduce operating load factors, will have the tendency to result in lowered individual load factors since load factor control efforts will be less cost-effective under this policy (and therefore of lower priority).

b. <u>Establishment of Uniform Provincial Rates</u>. Probably the most important results of uniform retail rates throughout Ontario will be an elimination of existing electricity system inequities. Presently, rates vary widely among users, depending on which supplier in the system electricity is bought from, and what special rates have been instituted. The rate restructuring in Rate Scenario B would abolish these rate differences (within defined user classes), except for a set user class customer charge which would reflect each retailer's individual costs.

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* *This ratio is changing rapidly. While 65/35 is the ratio for early 1975 (and has been used as a basis for study), the 1976 ratio is closer to 55/45.*

** *As noted in Figure II-2, this result would certainly provoke a negative reaction by the major power consumer's representative, AMPCO.*

While the vast majority of users will benefit by the elimination of price inequities, those industries presently having relatively low industrial rates (e.g., electric furnace rates) will be the most noticeably affected by higher costs. Those firms with special rates have effective discounts upon which they may rely for a continued competitive position in their respective market areas. Firms losing low rates will likely pass their increased costs through to the maximum degree (competitively) possible, while attempting to reduce electricity usage and/or retain their profit margin through such measures as shifts in product line. Moreover, the closure or relocation outside Ontario of some "discount" customers may well result from the abolishing of special rates.

The establishment of uniform retail rates throughout Ontario will also reduce municipality discretion in rate setting for the attraction of industries, although providing an easier separation of Ontario Hydro and municipal utility portions of retail bills. The greater separation of customer billing afforded by the uniform rates is an advantage to municipal utilities, in that, as bulk power rates rise, customer reaction may not be focused on the municipal retailers as much as on Ontario Hydro.

In the uniform rates set by Scenario B, a minimum demand billing (presently in common use) is not included. The minimum demand charge is usually a set percentage (e.g., 75 percent) of the previous 11 month's maximum KW demand. By abolishing this facet of billing, it was found that industries with seasonal operations (and therefore KW peaks) would no longer pay for electricity they do not use in off-peak months, thereby achieving lower bills. In the case of St. Lawrence Cement, it was stated that the minimum charge on off-peak months caused the firm to be less careful about electricity use during these months, since the firm was billed for more than it would use anyway. As a result, the abolishing of the set minimum would lower seasonal industries' costs, while reducing their waste of electricity.*

c. Peak/Off-Peak Rate Differentials for Large Users. There were two day-night pricing differentials outlined in Scenario B: (1) a 1.5 mill KWH price difference and (2) an

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***** *It is interesting to note that cement firms' off-peak months tend to be in winter months, during which Ontario Hydro's system peak occurs. Therefore, a set minimum charge tends to encourage waste by these particular firms when the system's need is the greatest.*

abolishing of peak (KW) measurements between the hours of 11 pm and 7 am. The 1.5 mill differential was in all cases felt to be too small to have any significant effect on electricity usage patterns or bills. The imposition of such a differential would, however, create a demand by large nighttime users for a still greater cost differential, and, perhaps, by smaller nighttime users for a similar cost break.

The option of having peak demand metered only between 700 and 2300 hours would encourage industries to, where possible, shift to nighttime usage. Lake Ontario Cement, for instance, would utilize any future excess grinding capacity in order to increase operations at night (thereby reducing the firm's daytime KW peak). Representatives of the firm felt, however, that the capital investments required for greatly increased grinding or storage capacity solely for the purpose of shifting usage heavily to the nighttime hours would not be cost-effective under Scenario B rates, and would not be taken. Labor union intervention in operational hour changes (as discussed previously with respect to the abrasives industry) would also inhibit the likelihood of day-night peak shifts. Therefore, although there will be efforts by industry to selectively take advantage of day-night cost breaks, immediate major shifts in usage should not be expected.

d. Bid-For Interruptible Power. Presently, interruptible power is almost exclusively available to Ontario Hydro's direct customers alone. This power is available in two classes, Interruptible A and B, each with set maximums for the frequency and length of interruptions possible and each offering a discount off firm power costs. In recent years, however, interruptible customers have rarely experienced power cut-backs (certainly, at least, no where near that allowed under their power contracts), and those industries interviewed typically regarded today's interruptible power as firm power at a discount.

Under the bid-for interruptible power option, "blocks"of power having realistically designated interruption frequencies and probabilities would be allocated to the highest bidder. Under this pricing mechanism, interruptions would not necessarily increase, but price discounts would be tied to the likelihood of interruption. It was found that none of the interviewed firms which presently buy interruptible power could afford to accept the level of interruptions allowed under their contracts.

To date, municipal utility customers have largely been excluded from buying interruptible power. In discussions with the St. Lawrence Cement Company (a municipal utility

customer), it was found that, although the firm had the capability to have certain electricity-intensive operations interrupted, it has never been offered the option by Mississauga Hydro.* Many such industries will be added to the pool of bidders for interruptible power under Scenario B. This factor, plus the fact that present interruptible power usage is probably not indicative of those industries' use under bid-for power, cause the market for interruptible power under the bid-for option to be extremely uncertain.

Both industries which now buy interruptible power and industries which will be buying it for the first time will act to increase their interruption capability, in order to gain maximum discount. Certain seasonal industries (such as the cement industry) will demand that interruption probabilities be given on a monthly or time-of-year basis, since they can accept a great deal of interruption at off-peak production times, but none during peak production periods. Some industries will selectively increase production and/or storage capacities in order to increase their discount. In the case of the Ontario Paper Company, it was noted that enlarged grinding capacity and/or pulp storage would aid the firm in increasing interruption capabilities, but would also add to the firm's ability to reduce its daytime peak under the peak/off-peak option of Scenario B. As a result, in some cases, the bid-for interruptible option and the peak/off-peak option will complement each other (and, together, make each individual option a more viable objective for consumers).

e. Lengthened Peak Demand Metering Period. Under Scenario B, peak demand would be measured over one hour, versus the present 20 minutes. Such a change would help those firms which have short "needle" peaks. By averaging the peaks over a longer period of time, the maximum KW demand for which the firm is billed can be lowered significantly. In the case of St. Lawrence Cement, it was stated that a lengthening of the peak measurement period would give operational personnel more time to react to electricity peaks, and thereby aid them in load control efforts to reduce electricity charges.

From an implementation point of view, the switch from a 20 minute to a one hour demand measurement period would be difficult. Discussions with Mississauga Hydro revealed that existing meters could not be easily recalibrated, and would probably have to be replaced at a cost of approximately $200 each. Also, it was pointed out that such a

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**This is due to the municipal utilities' charters, which, until recently, have restricted such agreements.*

change in metering may require regulatory action by the Federal Department of Weights and Measures. This step, then, would not be easily implemented though its likely impacts are very favorable.

f. Prohibition of Master-Metered Apartments. The elimination of master metered apartments (in new units) will primarily impact three parties: (1) the tenants, (2) the landlords, and (3) the utility. Tenants will be affected in that their electricity bills will be separate from their rental charge, causing a reduction in electricity usage (because of a greater individual responsibility for the electricity portion of apartment costs).

Individual metering will cause apartment construction costs to rise approximately $40 per unit (due to the added wiring required)*, but will remove the burden of rising electricity costs from the landlord. The fact that electricity costs are directly passed through to the apartment dwellers under individual metering will be especially favorable to landlords under rent control situations, as landlords are relived of the task of attempting to pass through any increases in electricity costs. Such favorable economic aspects of individual metering may provide impetus for more electrically-heated apartments in the future, and therefore a long-term trend toward greater electricity consumption, despite an initial conservation impact.

Municipal utilities will receive higher revenues from apartment dwellers under individual metering, but they would also incur increased customer service costs. Since residential (small user) rates are higher than bulk (large user) rates, a switch to individual metering will provide higher revenues (which will be offset, to some degree, by conservation efforts, however). An increase in the number of customers to be dealt with, meanwhile, will increase operating costs for the utilities. Direct billing to tenants may also increase bad debt problems for the utilities, as well.

B. General Observations

The overall trends perceived in this work, as well as some indications of the most fruitful directions for future activity, are stated briefly in the following.

1. Rapid electricity rate increases of the magnitude studied here would have an electricity conservation impact. Ontario Hydro's quantitative elasticity analysis will be valuable in determining the energy

**As reported by Mr. B. Howard, Meridian Building Group, March 1976.*

and capital implications of such rate increases for Ontario Hydro's capacity and revenue projections.

2. The magnitude of impacts due to the pricing policy changes studied is generally less than that of the impacts of doubling bulk power revenues by 1978, once logical adjustments to the rate restructuring are made by large users. To allow time for these adjustments to be made, the pricing policy changes should be phased in over a period of several years, rather than abruptly (as in Scenario B). Furthermore, publicized advance notice of both pricing policy and rate level changes would tend to minimize adverse impacts and maximize positive impacts, e.g., conservation of energy and capital resources.

3. From the cooperative and interested responses of the organizations and individuals approached in conducting this study, it is concluded that impact assessment presents a valuable and welcome customer participation avenue as well as an analytical tool for making better rates.

4. Both the position and case study evaluations of Ontario Hydro's proposed bid-for interruptible service option indicate strongly that more information must be provided to the potential participants to enable them to understand this pricing concept. Some form of educational program could provide this information to customers, while allowing Ontario Hydro to further assess the impacts of bid-for interruptible service.

5. Responses from small-consumer groups to peak/off-peak rates were incomplete because, in Scenario B, only large users were to be offered these rates. However, smaller users (less than 3000 KW demand) are definitely interested in having peak/ off-peak rates extended to them.

6. A bulk power rate doubling over three years may cause change in employment levels and locations in Ontario. In general, the changes in employment noted here were small and negative, principally in the most electricity-intensive industries. However, such industrial job losses have secondary employment effects as well. Reduced industrial wage and tax inputs to the economy (especially at local levels) would impact service jobs such as in hospitals, schools, theaters, and restaurants, as well as jobs conjunctive to the industry itself (e.g., in timber areas for the paper industry). Some of these industrial job losses and many of the secondary job reductions would not be "lost" to the Province, as certain other development will occur elsewhere in

Ontario (see Figure II-1). However, even in these cases, local economic hardships and family dislocations (perhaps not evident at the provincial level) may be experienced as a result of rising electricity costs to electricity-intensive industries.

7. Rising electricity rates can also cause shifts in the type and locality of pollutant sources and receptors in Ontario. Any industrial closures or re-locations will eliminate associated pollution emissions. Resultant family dislocations, on the other hand, will shift receptor concentrations and localities. Efforts by customers to reduce purchased electricity, especially if through electricity self-generation, will also incur localized changes in pollutant emissions.

8. A doubling of bulk power rates may place municipal utilities in the position of having to increase services while under customer pressure to reduce costs. The customer charge rate component of Scenario B tends to isolate municipal utility charges and, thus, partially assures that municipal utilities will not become foci of negative customer reaction to bulk rate increases.

9. Two of the pricing policy changes of Scenario B would shift the emphasis in large user load management from monthly load factor control towards diurnal peak/off-peak control. Those changes are the 35/65 demand/energy revenue split and the use of peak/off-peak rate differ-entials. However, a third aspect of Scenario B, lengthening the peak demand measurement period from 20 minutes to one hour, may actually offer increased incentives for active peak demand control programs (thus increasing load factors). This change, as per-ceived by some, would allow more reaction time for load management responses to be effective in curtailing demand peaks.

10. The potential exists for degradation of the system load factor following the institution of a 35/65 demand/energy revenue split. The actual extent of this tendency would best be gauged by experience during a phased change in D/E split over several years. Careful observations of the short-run relationship of load factor to D/E split could guide Ontario Hydro in determining the appropriate schedule for phasing in a marginal cost-based D/E split.

11. Strongly divergent views have been found of the abolition of bulk metering in new apartments. The volatility of this issue appears to lie in the uncertainty in the costs and benefits involved, and in the moral bases of oppositely held positions.

III. TWO RATE SCENARIOS

The term rate structure, as used in this report, refers to the form of the wholesale and retail pricing system used in the sale of electricity. Ontario Hydro presently employs as its nominal rate structure a two-part system, with demand (KW) and energy (KWH) charges set for various customer classes. Other general features of Ontario Hydro's current pricing system include:

(1) the specific demand and energy measures used,
(2) the system's demand/energy revenue split,
(3) the role of municipal utilities in retailing,
(4) interruptible service contracts, and
(5) bulk metering of multifamily apartments.

In the application of Ontario Hydro's rate structure, demand charges are expressed in terms of dollars per kilowatt. Each customer's billing demand is taken as the monthly maximum (or peak) measurement recorded by a meter with a 15 or 20 minute averaging time constant. Only customers with an annual average monthly non-coincident peak demand greater than 50 KW are assessed a demand charge. Energy charges are expressed in terms of cents or mills per kilowatt hour. Energy is measured as the time integral of demand over the monthly billing period.

A key parameter in this rate structure is the system's demand/energy revenue split, which is the sum of all revenues received through demand charges divided by the sum of all revenues received through energy charges. Ontario Hydro's 1975 demand/energy revenue split was about 65/35.

From the customer's viewpoint, the demand/energy split is an important price signal. Relative emphasis on demand charges encourages the customer to minimize his peak demand, thereby smoothing his load pattern over the monthly billing period. This results in a higher "load factor" for the customer, and for the utility system. The higher the system's load factor, all else being equal, the more efficiently the system's power capacity is being used.* Ontario Hydro's annual load factor is presently about 69 percent, one of the highest in North America.

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* *Load factor, however, is not the only such indicator.*

The fully distributed costing method distributes the total revenue requirement among several variable and final cost pools according to the average costs associated with all electricity sold by the utility. During a period of increasing costs in one of these cost pools (e.g., energy costs), it can be argued that FDC gives customers the wrong price signals on which to base their buying decisions. A costing method which prices at the margin (of demand) is long-run incremental costing (LRIC). This method can be used to distribute the total revenue requirement among cost pools according to the costs associated, in the long-run, with the next increment of electricity sales. Today, use of LRIC would lead to a system demand/energy revenue split of approximately 35/65 for Ontario Hydro.

Hydro sells electricity at wholesale rates to some 353 municipal utilities throughout Ontario. These utilities distribute power locally and sell to retail customers. In addition, Ontario Hydro, through its Rural Power District, acts as a supplier for many large industrial customers, as well as for residential and commercial customers (mainly in rural areas). Each municipal utility sets its own retail rate schedule, subject only to the approval of Ontario Hydro. As a result, there exists wide variation among municipalities in the rates charged to the same customer class, and even some variation in the definition of customer classes.

Ontario Hydro's rate structure does not make direct use of the diurnal, or time-of-day, variation in its system demand. Ontario Hydro's system demand is made up of the sum of all individual customers' metered kilowatt demands at any given time. The maximum, or peak, system demand determines the installed generating and distribution capacity required by the utility. It can be argued that customers whose peak demand is coincident with the system's peak demand contribute more to system capacity costs than do customers whose measured peak demand occurs during system offpeak hours. The daily system peak generally occurs between 0700 and 2300 hours.

Interruptible service contracts have been provided by Ontario Hydro to certain large industrial customers. These customers receive a discounted rate for the "interruptible" portion of their electricity demand, in return for giving Ontario Hydro the legal right to interrupt this portion of their service during specified system load conditions. Historically, actual interruptions have been far less frequent

than permitted by the interruptible service contracts. Some inequity has existed in the system, in that only direct customers, in general, have in the past been able to obtain interruptible service rates. Presently, the problem is merely that many municipal power customers are unaware of their ability to purchase interruptible power.

Most apartment buildings in Ontario are bulk metered, in that electricity meters are used for groups of rented dwelling units, rather than for individual apartments. Thus, the landlord pays the total electricity bill, and passes the cost on to the tenants through rents. Ontario Hydro and many municipal utilities have encouraged bulk metering strongly, in the past, as a policy to reduce operating costs. However, recent studies indicate that bulk metering tends to increase electricity consumption, since bulk metered tenants do not pay directly, and have no direct control over, their electricity bills.

Two rate scenarios were studied in this program. The first involves a straightforward doubling of Ontario Hydro's total annual revenue requirement between 1975 and 1978, with no change in the current rate structure or related features of the overall pricing policy. A more traditional electricity rate growth is resumed after 1978. The second rate scenario studied also doubles Ontario Hydro's bulk revenues by 1978, but this scenario introduces a new rate structure in that year. This rate structure meets in principle the same total revenue requirements as Scenario A, though in some very different ways. It involves significant change in all of the pricing features described before.

These scenarios are more completed delineated in the following:

A. <u>Rate Scenario A</u>

(1) <u>Nominal Description</u>
Double bulk power rates by 1978.

(2) <u>Effect on Customer Rates (¢/KWH)</u>
1978 -all $<$ 5000KW rates = 1.9 x (1975 rates)
-all $>$ 5000KW rates = 2.0 x (1975 rates)
1983 -all $<$ 5000KW rates = 3.0 x (1975 rates)
-all $>$ 5000KW rates = 3.14 x (1975 rates)

(3) <u>Conditions</u>
a. Bulk rate to municipalities and RPD doubles between 1975 and 1978.
b. Because distribution costs are not rising with fuel costs, the net effect on $<$ 5000KW customer's bills is a factor of 1.9 between 1975 and 1978.

c. Rates of all large users (over 5000KW) in and out of the Power District double by 1978.
d. All rate components increase by a factor of 1.57 between 1978 and 1983.

B. Rate Scenario B

(1) Nominal Description

Double the bulk power rate by 1978; in 1978 introduce a new rate structure with three general features -

a. Change the system D/E revenue split from approximately 65/35 to 35/65,
b. For three newly defined user categories (<50 KW, 50-3000KW, >3000KW) set standard demand and energy rates throughout Ontario, and
c. Use a customer charge to price fixed costs, thus enabling municipal utilities to meet their individual revenue requirements.

(2) Effect on Customer Rates

-1978-

	0-50KW	50-3000KW	>3000KW
\$C.C.	\$4/customer	\$400/customer	\$3000/customer
¢/KWH	2.77¢/KWH	1.8.¢/KWH	1.68C/KWH
\$/KW	0	\$3.42/KW	\$4.31/KW

-1983-

	0-50KW	50-3000KW	>3000KW
\$C.C.	\$6.50/customer	\$630/customer	\$4700/customer
¢/KWH	4.3¢/KWH	2.84¢/KWH	2.64¢/KWH
\$/KW	0	\$5.37/KW	\$6.77/KW

(3) Condition

a. Bulk rate to municipalities and RPD doubles between 1975 and 1978.
b. Because distribution costs are not rising with fuel costs, average rates in the 0-50KW and 50-3000KW user categories increase by a factor of 1.9 between 1975 and 1978.
c. Average (large user) rates in the over 3000KW category double between 1975 and 1978.
d. All rate components increase by a factor of 1.57 between 1978 and 1983.
e. End user demand and energy charges are set uniformly by Ontario Hydro.

f. Municipal utilities and the RPD can adjust customer charges within prescribed limits to meet revenue requirements.

(4) Concepts for Sensitivity Study

a. Peak/off-peak rates for large users (>3000KW). Non-coincident peak demand measured only between 0700 and 2300 hours; approximately .15¢/KWH peak/off-peak energy charge differential.
b. Prohibition of master metering of new multi-family dwellings and existing buildings where feasible.
c. Bid-for interruptible service option for all large users.
d. Change the 20 minute peak demand measurement to a one hour measurement.

IV. THE IMPACTS OF RATE CHANGE-CASE STUDY ANALYSES

This chapter presents the results of eleven case studies of the impacts of rate change.

The decision criteria used in selecting the subjects for these studies accounted for the following: (1) representative industrial, commercial, institutional, and residential subjects were desired; (2) varying load sizes, patterns, and load factors were sought; (3) customers of both Ontario Hydro's Rural Power District and various municipal utilities were included; (4) only willing subjects were studied, and; (5) the total number of cases was consistent with the resources and time available for the assessment. The eleven case study subjects include the following:

- The Ontario Paper Company, Ltd.
- Canadian Carborundum Company, Ltd.
- Lake Ontario Cement, Limited
- St. Lawrence Cement Company, Ltd.
- Lake Ontario Steel Company, Ltd.
- Marks and Spencer, Retail Chain Store
- Prudential Assurance Co., Office Building
- Toronto General Hospital
- One Fountainhead, Apartment Building
- A Hypothetical North York Single-Family Dwelling
- Mississauga Hydro, Municipal Utility

Representatives of the various firms involved in these studies were asked to respond informally to the rate scenarios, and provide whatever data and information was available to document their opinions. *Their opinions cannot, however, be taken in any sense as the official responses of the subject firms.*

The case studies are presented in the order listed above. Each includes a brief description of the industry, commercial activity, institution, or residential dwelling type of which the study subject is representative. The discussion of Scenario A and B rate impacts extends to secondary and higher order effects, involving regional, Provincial, and local economic and societal implications as related specifically to the individual case study. A summary for each case highlights major impact potentials.

A. Pulp and Paper Industry Case Study: The Ontario Paper Company, Ltd.

Ontario is one of the world's leading producer of pulp and paper products. Of this industry's energy consumption, approximately one-third is in the form of electricity. It is for this reason that abundant, inexpensive electric power (historically available in Ontario) was a major factor to this industry's development in the province (Ref. IV.1). Today, the Pulp and Paper Industry is the province's largest single electricity consumer (using 17.6 percent of the 1972 total), and its second most electricity intensive (with electricity being 8.5 percent of the industry's value added in 1972) (Ref. IV.2).

The paper making process consists of three basic steps. First, the logs are debarked, with the bark commonly being collected for use as a fuel. Next, the log is reduced to either chips or groundwood, depending on the pulping process selected. Finally, the pulp product (often times a mixture of chemical and groundwood pulps) is refined using various machines which reduce the pulp and separate its fibers, and is fed into a paper machine. Here, the mixture of fiber and water is progressively matted, pressed, dried and cut into paper or paperboard.

In chemical pulping, the wood is reduced into one-half to three-fourths inch chips by a mechanical chipper (using electric drive). The chips are then mixed with chemicals and cooked in a pressurized digester to remove its lignin component. The result is a cellulose fiber pulp and a waste liquid. This waste liquid can be partially evaporated and used as a fuel, but it can also be used to make other sale-able products (Refs. IV.1, IV.3).

In mechanical pulping, the logs are reduced by physically pressing the logs against a revolving, electrically driven grindstone. The groundwood pulp (which retains the wood lignin) is then screened and filtered. The resulting pulp's fibers are shorter and weaker than the chemical process pulp, but the mechanical process produces less waste material and discharges effluents of lower B.O.D. than the chemical process. The mechanical pulping process uses more electricity per ton of product, however (Refs. IV.1, IV.3).

The Ontario Paper Company, located in Thorold, Ontario (on the Niagara peninsula of Ontario) is a wholly owned subsidiary of the Tribune Company. The Tribune Company publishes the Chicago Tribune, the New York Daily News, the Fort Lauderdale News, and several other U.S. newspapers. The Ontario Paper Company also owns the Quebec North Shore Paper Company. The Ontario Paper Company's primary product is newsprint, its newsprint capacity being 240,000 tons/year (in 1974 it actually produced 232,437 tons), with this production primarily serving the Chicago Tribune's needs (Refs. IV.4, IV.5).

The Thorold paper mill, built in 1913, has been modified over the years to become an integrated mill, producing secondary products including, sulfite pulp, alchohol, vanillin, and salt cake (the product of an effluent recovery system). The pulp mix used in the newsprint production is composed of approximately 75 percent groundwood pulp* and 25 percent chemical (sulphite) pulp. As a result, Ontario Paper (like most newsprint mills) is more electricity intensive than multi-product mills using a lower percentage of groundwood pulp. The waste liquid from the sulphite pulping plant is fed to the alcohol, vanillin, and salt cake operations (Ref. IV.6).

Since the pulp mill's waste liquid is used in the manufacture of secondary products, it is not utilized for electricity self-generation purposes (as it is by some competitors). Self-generation capabilities are further reduced in that the firm's logs (which must be shipped from northern Ontario) are debarked before transport. A total of 17 percent of the firm's electricity is supplied by turbines at an on-site steam plant (built for process needs). The plant supplies 400 psi steam, 80 percent of which is run through turbines (reducing it to 125 psi steam) before being used in the paper, alcohol, and vanillin operations. From these steam turbines come approximately 11 MW of power (Ref. IV.6).

1. Rate Scenario Impacts

a. Scenario A. As discussed previously, the Pulp and Paper Industry is very electric intensive. As a whole, however, newsprint producers are more electricity intensive than the overall industry, due primarily to their large use of mechanical grinders. Since the Ontario Paper Company manufactures only newsprint (a relatively electricity-intensive paper product), an electricity cost doubling would impact

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* *The firm has 15 two MW grinders.*

their production costs to a greater degree than many of their competitors having a more varied paper product mix. They must remain competitive, however, and a "do-nothing" option is not considered to be a viable approach for the Company to follow. As a result, it would be advantageous to Ontario Paper to reduce their purchased electricity requirements if rates were to double.

The Ontario Paper Company has already begun to investigate several options which would either reduce their electricity intensiveness, or increase their self-generation capabilities in Thorold. The option of self-generation is probably the furthest along in development.

In March of 1975, a consortium, composed of the Consumers Gas, Ltd. of Toronto, the Canadian Industries, Ltd. of Montreal, and the Ontario Paper Company, publicly outlined a plan by which they would incinerate municipal trash to produce electricity and process steam (Ref. IV.7). The incineration-generator plant has initially been estimated to have a 1000 ton daily trash capacity, and a cost on the order of 50 million dollars (Refs. IV.8, IV.9). The plant would be an integrated scrap recovery, garbage incineration, and electricity-steam generation system located on Ontario Paper's Thorold property. This is a seriously considered option, and a preliminary technical feasibility study of this plan was conducted in 1975 (Ref. IV.7).

An incinerator of these proportions would consume essentially all of the Niagara region's solid waste, and would require cooperation of all the major municipalities. Initial reaction by adjacent municipalities was positive, since waste disposal is a serious concern of local governments (Ref. IV.8). It is presently planned that the incinerator-generator plant would supply Ontario Paper with approximately half of its power requirements and would replace its present steam plant. As of January 1976, it was estimated that the plant could be in operation by 1980 (Ref. IV.9). At the time of the public announcement of the incinerator-generator proposal, Ontario Paper representatives cited the firm's 1974 electricity costs (three million dollars) as a major factor in their participation in the plan (Ref. IV.10). The rate doulbing projected by 1978 in Scenario A would increase this incentive for the plan, and make this proposal a more realistic option.

Secondary impacts of the move by Ontario Paper to burn municipal trash for electricity and process steam generation are many fold. The step would (for this region)

eliminate the problems and costs associated with solid waste measures such as landfill operations. Since it will be a recycling plant as well, this is also a positive step towards reducing resource consumption in Canada. There is, however, some controversy over possible local pollution impacts associated with the plant. While consortium representatives state that there will be absolutely no pollution associated with the incineration-generation plant (the incinerator is to have an electrostatic precipitator with a 99 percent design efficiency), concern about potential pollution from the operation has been raised by local public officials (Refs. IV.7, IV.11). Another impact of the plan would be reduced demand for Ontario Hydro Power, which would free present generating capacity to serve other consumptive growth. It is difficult to assess the total employment impacts of the plan, but it is expected that it would eliminate very few jobs (in areas such as land-fill operations), while creating many more for the plant's operation and the fabrication and construction of the new facility. This reaction to rising electricity costs, then, will have effects in the areas of resource and power consumption, solid waste disposal, and employment.

Ontario Paper has other options through which to react to rising electricity costs, one of which would involve a process change to reduce plant consumption. Today, some 55 percent of Ontario Paper's electricity use is in its mechanical pulp grinding operations (Ref. IV.6). For this reason, Ontario Paper is considering replacing approximately half of its groundwood pulp with pulp from de-inked waste news.* This step would require an investment in a de-inking and recycling plant, but could reduce the plant's total electricity consumption by as much as 25 percent (Ref. IV.9).**

The secondary impacts of using recycled pulp are largely in wood consumption and employment. At the mill, the grinders are more labour intensive than the machinery required for the recycled pulp. The company would, most probably, retrain its present employees to serve the new process. The largest negative impact will therefore be felt at the company's logging and barking operation (in northern Ontario) and by its wholly owned transport company, as the recycling plant should reduce the wood to be cut and moved to the Ontario Paper by over one-third. Some positive

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**This amount of used newsprint, it is felt, can be collected within a 200 mile radius of the plant (Ref. IV.9).*

***There is an additional incentive for a switch to the recycled paper process, and that is recycled newsprint's relatively low cost. Presently, Ontario Paper must transport their logs a long distance, resulting in wood costs higher than their competitor's (Ref. IV.6).*

labour effects would be experienced as well, however, as a paper recycling system will have to be set up and operated, and the new equipment purchased will also support employment in the machinery fabrication industry.

The proposal to reduce electricity-intensive grinding operations is of further interest, however, in that it is exemplary of a rate impact discussed in the Abrasives Industry case study. The grinding stones used in the mechanical pulping operations are coated with Silicon Carbide, a synthetic abrasive. This grinding process like most other abrasive processes, is very electricity intensive making it the obvious target of efforts to reduce electricity consumption in Ontario Paper's operations. The proposal to reduce grinding operations to save on electricity costs is an example of the potential for reduced abrasive product demand as the price of electricity rises.*

Ontario Paper could also expand their present electricity self-generation (now 11 megawatts) by installing additional steam turbines within their present system. This can be accomplished at several stages in the process, but the largest single source of additional power would be the 20 percent of process steam which does not now go through turbines before going to the salt cake operation. By adding a turbine here, and by several other lesser steps, it is felt that the self-generation from the process steam could be boosted as much as 50 percent, or to about 17 MW. The profitability of such a step will depend, however, on the future price of purchased electricity.

These three options: trash combustion for power, paper recycling, and additional steam turbine generation, act to reduce Ontario Paper's need to purchase power from Ontario Hydro. Because of this, each is an alternative to paying higher electricity bills. It is interesting to note, however, that all three of these measures, enacted together, would cause the Ontario Paper Company (at present production level) to reduce its total electricity demand to approximately 45-50 MW, while increasing its self-generated electricity to just about that same level (30 MW from the incinerator-generator, and 17 MW from steam turbines within the firm). As a result, the Ontario Paper Company could (with considerable capital investment) become increasingly electricity self-sufficient in just a few years.

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* *See the Abrasives Industry Case Study for further details.*

Finally, the alternative of the Tribune Company not to invest the capital required for the previous measures must be considered. Though this option is not presently being considered by the company, the Thorold plant is an old one, and it is possible that a decision could be made by the Tribune Company not to invest in the plant at this point. Due to the Thorold plant's relatively high operating costs and age, the Tribune could decide to place new expansion elsewhere, or even to close the Thorold Plant down. The Tribune, then, has the option of closing down the plant and/or expanding elsewhere, where operating costs are lower (Ref. IV.6).

The economic impacts of lost industrial jobs can be significant. The loss of jobs would be greater (in terms of total employment) than plant employees alone. Many secondary jobs in service areas such as schools, hospitals, movie theaters, and restaurants are impacted by a loss of industrial wages and taxes to the community. Other jobs, conjunctive to the paper firm, would also be lost, such as in woodland areas. Clearly, a closure or loss of new expansion at this mill as a result of increasing production costs would have significant economic impacts, especially in the Thorold vicinity.

b. Rate Scenario B. The impacts on the Ontario Paper Company of Scenario B are essentially the same as for Scenario A. However, the potential for an increase in the firm's electrical bill (before operational adjustments) is greater. For example, with no operational changes, Ontario Paper's 1978 electrical bill would be nearly triple the actual 1974 bill if Scenario B was in effect, versus a doubling for Scenario A.* The alternatives of the firm to react under Scenario A (increase self-generation, reduce consumption, or shut down) are also the major options to the Scenario B rate increase. The rate restructuring does, however, present its own distinct impacts, while also offering another option to the firm.

The Ontario Paper Company must operate at peak capacity to meet demands, although the mill can afford to have its grinder interrupted for up to eight hours at a time (the limit of their pulp storage capacity). As a result, the firm buys approximately 65 percent of its power as interruptible. The number of interruptions per year must be few, however, as the mill lacks the excess grinding capacity to refill its storage once production is restarted (Ref. IV.6). Therefore, if Ontario Paper were to be interrupted as often as their existing contract allows, interruptible

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**This, assuming that the firm continues to get a 13 percent discount for interruptible power, as in 1974.*

power would probably be unacceptable to use (with present pulp grinding capacity). Presently, Ontario Hydro rarely if ever interrupts its customers, however, and the interruption problem has not presented itself in recent years.

With bid-for interruptible power, the power would be discounted based on realistic probabilities of interruption. It seems doubtful that, without the addition of greater pulp-making capacity, Ontario Paper could accept a high enough (realistic) probability to retain its 1974 interruptible discount of 13 percent. Therefore, Scenario B would further impact Ontario Paper in that it would likely require the firm to invest in additional grinding capacity in order to maintain an interruptible power discount.

The peak/off-peak aspect of Scenario B would allow Ontario Paper a new option for savings, both in terms of kilowatts and kilowatt-hours. The kilowatt-hour peak/off-peak differential given in Scenario B would not be large enough to cause Ontario Paper to shift to increased off-peak production (Ref. IV.6). The factor of the non-coincident peak demand measurement would have the potential for larger savings, however, when combined with the additional grinding capacity which (under this rate scenario) may be required to maintain an interruption capability. In other words, with the implementation of Scenario B, Ontario Paper would have the new option of increasing pulpwood grinding capacity* in order to (1) maintain or increase its present interruptible discount, and (2) allow Ontario Paper to reduce operations during the day (when a peak would be measured), while increasing operations at night (when the peak would not be measured).

This new alternative (shifting production day to night) would not result in any employment changes within the firm (other than shifts in hours worked on the grinders). It would, however, result in capital expenditures for new equipment, and therefore stimulate employment in other sectors of the Canadian economy.

The initial impact of Scenario B on Ontario Paper would be to make the financial burden of purchased electrical power even greater than under Scenario A. As such, it would make the alternatives to paying more for electrical power all the more imperative and probable than would be the case for rate Scenario A.

**Perhaps combined with additional pulp storage capacity.*

2. Impact Summary

Electricity rate increases will impact operating costs in the Pulp and Paper Industry, especially in those establishments which produce pulp using grinding operations. As this case study pointed out, however, the industry has many options that it can (and probably will) take to reduce purchased electricity as its price increases. In this specific case, these options included using a more energy efficient paper recycling process, burning municipal trash for power, and better utilization of process steam to produce electricity. Certain purchased power utilization changes (such as off-peak hour production) are available under Scenario B as well, but these appear less cost effective (and, therefore, less probable) than steps to reduce the actual quantity of power purchased. As a result, it appears that, as power costs rise, paper companies will either reduce purchased power through conservation and self-generation, or face higher operating costs and their associated implications.

B. Abrasives Industry Case Study: Canadian Carborundum Company, Ltd.

Synthetic abrasives are manufactured and sold by 15 Ontario firms. The crude abrasives are commonly exported for processing into final abrasive products such as grinding wheels and sand paper. Ontario supplies approximately 70 percent of the western world's crude aluminum abrasives, and over half of its silicon carbide products (Ref. IV.12). Several firms, including Canadian Carborundum Company., Ltd. and Noeton Company of Canada, Ltd. (the two largest Ontario firms), have integrated their operations so as to make both crude and finished abrasive products for domestic demand.

Today, Silicon Carbide and fused Alumina are the two major crude synthetic products. Fused Alumina abrasives (made from bauxite) are used largely for grinding operations involving heat treated materials. Silicon Carbide abrasives (made primarily from coke and sand) are commonly used for grinding hard, brittle materials like iron castings, or for soft metals such as aluminum (Ref. IV.12).

The abrasives plant chosen for study, the Niagara Falls operation of the Canadian Carborundum Company, primarily produces fused alumina products. There are three types of electric arc furnaces which can be used to produce fused alumina: (1) the pot type, for batch operation; (2) the tilt type, for continuous operations; and (3) the tapping type, also for continuous operation. Installation since World War II have favored the continuous tilt type furnaces, how-

however, chiefly because of the labour savings associated with their operation. The high temperatures required in these alumina furnaces (for the reduction of the bauxite ore feed) necessitate the use of electric furnaces. As a result, electricity is very basic to this industry's operation. (Refs. IV.12, IV.13). The electricity consumption by this industry is such a large portion of its costs that it is the province's most electricity intensive, with electricity costs being 18.8 percent of the industry's total value added in 1972 (Ref. IV.2). As such, the consequences of electricity rate modifications will be of particular significance in this industry.

The electricity intensiveness of the abrasives industry has caused it to develop near abundant, cheap electricity sources. As a result, the Ontario abrasives industry is concentrated in and around Niagara Falls, where, historically, economical hydroelectric power has been available. Today, over 90 percent of the abrasives industry's employment is concentrated in the Niagara peninsula of Ontario (Ref. IV.12).

The Canadian Carborundum plant in Niagara Falls produces various crude and finished abrasive products, the most important being crude fused alumina and abrasive wheels and segments. Canadian Carborundum has 14 furnaces at this plant, six of which are Higgins batch type furnaces, and eight of which are continuous tilt furnaces (Ref. IV.14).* The plant's present fused alumina capacity is approximately 100,000 tons per year. In 1974, the company shipped approximately 75,000 tons of crude alumina (Ref. IV.15). An important addition to the plant's capacity will occur in the first quarter of 1976, when a continuous tilt type furnace (the largest of its kind ever built) will start production. This labor and electricity efficient furnace will be large enough to alone meet all of Carborundum's fused alumina needs.

1. <u>Rate Scenario Impacts</u>

a. <u>Scenario A</u>. Because of the electricity intensiveness of the synthetic abrasive industry, it is expected that there will be an overall reduction in the competitiveness of Ontario's synthetic abrasives as the province's electricity rates increase. Sales of cutting tools using natural abrasives (e.g., diamonds, garnet, and corundum) would rise, while foreign-made synthetic abrasives would be a more viable

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These interviews, along with the data in Reference IV.15, provided the basis for essentially all the following case study discussion.

competitor in North America (Ref. IV.14). Demand for industrial and bonded abrasives products, in general, would decline as well. Grinding operations are both labor and energy intensive, and there has been a trend toward the use of molded plastics, aluminum castings, extruded aluminum sections, and other alternatives to grinding operations (Refs. IV.12, IV.14). A doubling of electricity costs by 1978 would require synthetic abrasives prices to rise, thereby further advancing this trend away from grinding operations and the use of industrial and bonded abrasives (which represent over 75 percent of Carborundum's production).*

Approximately one quarter of Canadian Carborundum's fused alumina production is in the refractory market. Fused alumina refractories have been making gains in this market since they became competitive with tabular alumina in about 1968. Presently, they represent about 25 percent of the North American refractory market. Greatly increased electricity costs would require a rise in the price of Ontario's fused alumina product and, in such a marginal market, would result in an inability to compete with the American-made tabular alumina product (Refs. IV.12,IV.15).

Since the synthetic abrasives industry must use electricity to achieve the temperatures required in the bauxite reduction process, Canadian Carborundum feels the most realistic options to actively cope with electricity rate increases are either to:

(1) Move all existing tilt furnaces to its New York or Quebec facilities. In New York, the firm has a long-term contract (through 1992) for enough electricity to meet the demands of these furnaces. This contract provides relatively lower electricity costs than Ontario Hydro's present rates, and significantly less than those projected in Scenarios A or B.**

(2) Partially or completely shut down crude abrasive operations, starting with the least efficient (batch) furnaces. The Niagara

**See the Paper Industry case study for a relevant example of this trend.*

***It should be noted that this is a unique situation which is due to the fact that Carborundum was one of the New York utility's first large customers (Ref. IV.14).*

Falls bonded plant would continue operations by buying crude alumina from government stockpiles as needed.*

Relocation of their furnaces would not create major problems. In fact, Canadian Carborundum now plans to move one furnace (No. 14) to their New York operations in January 1976. It is estimated that it would cost approximately $150,000 to move each of the continuous furnaces to New York, an investment which would take only one year to regain (at the lower New York electricity rates). Canadian Carborundum would not consider moving the new tilt furnace, however, due to its size and installation costs. As part of option No. 2, the furnace could eventually be shut down, but only after returning its initial investment over a number of years. Bauxite supply costs are not a consideration, as Canadian Carborundum is presently supplied by mines in South America, and the transport involved would not be affected (Ref. IV.14).

It may, at first, seem incongruous to have built a new large furnace (in light of recent announced rate increases and the stated options above). However, this furnace was planned and begun before such rate rises became apparent. Plans for a second such furnace at the company's Niagara plant (as well as to initiate new products) have now been scrapped.** On the other hand, the greater efficiency of this large furnace, as well as Canadian Carborundum's unique ability to shift production to their U.S. or Quebec operations, makes Canadian Carborundum representatives confident that they will be at an advantage over their competitors in the remaining abrasives market as rates rise in the future.

The job implications within Canadian Carborundum of the two options could be significant. Some 40 to 50 unskilled laborers are to be laid off when the eight batch furnaces are shut down in 1976, and an additional 100 would be laid off if the six larger tilt furnaces were moved to New York.*** The bonded plant would be unaffected. In total approximately 150 of 425 employees will be laid off in these steps are taken (Ref. IV.14).

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* *It is estimated that government stockpiles could supply all the Canadian fused alumina demand for several years (Ref. IV.14).*

** *The expansion and new production will still take place, but will not occur in New York or Quebec.*

*** *Although the tilt furnaces would not have to be moved very far, international regulations would prohibit such unskilled Canadian employees from commuting to work in the U.S. (Ref. IV.14).*

The opinion was expressed that, as a result of being unable to compete in a limited abrasives market, several or all of Canadian Carborundum's competitors would be forced out of business in Ontario (Ref. IV.14).

The fact that the abrasives industry is now concentrated in one geographical area of Ontario indicates that the greatest concern may be the influence of such reductions on the Niagara Falls area's economy. Moreover, much more than just the jobs of abrasive industry employees are at stake in this situation. The persons employed by the abrasives industry (and their families) require services such as schools, hospitals, movie theaters, restaurants, etc. If there is a reduction in industrial jobs, then this will, in turn, incur reduced secondary sales and employment in the local areas surrounding these industries.

b. Scenario B. The impacts of Scenario B (and the company's response to those impacts) will be the same as for Scenario A, except that the cost increase (before adjustments) will be even greater. For example, if Scenario B's 1978 rates were to have been in effect in 1974, the company's bill would have been more than two and a half times larger than it actually was** (versus a doubling under Scenario A). The reason for Scenario B's greater impact is that Canadian Carborundum is a large electricity user (in KWH), but operates with a relatively high load factor (89 percent in 1974). Scenario B's shift of billing emphasis to energy use (rather than peak demand) therefore causes Canadian Carborundum to be more severely impacted by this second rate scenario.

Canadian Carborundum presently works a continuous operation, and it is felt that it would not be advantageous to change shifts as a result of peak/off-peak rates or the new D/E billing split. At the most, Canadian Carborundum might operate the new furnace more heavily at night to take advantage of a price differential. The firm uses interruptible power, but the new bid-for-nature of these rates was not a concern.

This, assuming the company continues to get the 10 percent interruptible discount it received in 1974 under the bid-for interruptible plans, and with no operational adjustments.

Some of Canadian Carborundum's competitors who presently work normal five day weeks could make more significant changes in their operations, moving towards continuous operations. But, since they presently do not require their employees to work nights, some serious labor problems could ensue from such a move.

2. Impact Summary

The implications of electric rate increases to the abrasive industry appear to be significant. As seen through discussions with Canadian Carborundum, the net result of electricity cost increases could be a substantial reduction in Ontario's abrasives production and employment. Already, recent rate increases have caused Canadian Carborundum to scrap plans for new expansion, and to move some of its present capacity out of Ontario to the U.S. The loss of basic industrial jobs can have substantial implications (in terms of lost taxes and employment) to other sectors, and, as such, can incur an economic impact in the local area surrounding an industry. This is especially true in this specific case, where the entire industry is geographically concentrated. Such localized "compounded" economic implications of rate rises are less easily determined than direct employment and cost impacts, but may well be of greater significance.

C. Cement Industry Case Studies: Lake Ontario Cement Limited and St. Lawrence Cement Company

In 1971, the Canadian Cement Industry consisted of 10 firms, operating 26 establishments. By 1973, the number of establishments rose to 27, seven of which were located in Ontario. Ontario plants shipped over 93 million dollars worth of cement products in that year, or some 37 percent of the nation's total (Ref. IV.16, IV.17). Most of Canada's cement production is for domestic use in construction projects (in 1973 only 10 percent of the nation's production was exported). Since virtually all cement is used in one or another type of construction (See Table IV-1 below), the Cement Industry, like the construction trade, tends to be a seasonal industry (with peak demand in the summer months).

TABLE IV-1

CANADA, PORTLAND CEMENT SHIPMENTS, 1968 1972

General Market Segment	1968	1969	1970	1971	1972
	(thousands of short tons)				
Residential	2,122	2,092	1,874	2,406	2,636
Industrial and commercial buildings	1,891	1,389	1,237	1,366	1,305
Public buildings	1,396	1,040	1,078	959	1,029
Heavy construction	1,600	1,805	2,001	2,266	2,519
Miscellaneous	558	1,006	877	898	619
Total	7,567	7,332	7,067	7,895	8,108

SOURCE: Cement in Canada, Department of Energy, Mines and Resources, Ottawa, 1973, pg. 74.

There are four basic steps in the manufacture of Portland cement (the overwhelming type of hydraulic cement produced). First, raw limestone is mined and crushed to approximately three-fourths inch stones. It is then mixed in proper proportion to other crushed raw materials containing silica, alumina, and iron. Second, the mixture is ground into a powder or slurry (depending on whether a "dry" or "wet" blending process is used). Third, the mixture is calcinated in a cylindrical rotary kiln until fused into marble-size silicates called "clinker". Finally, a proportioned mix of clinker and gypsum is ground to form portland cement (Refs. IV.16, IV.18).

In terms of electricity consumption, cement manufacturers are among Ontario's more intensive users. In 1972, the cement sector was the province's fourth most electricity intensive industry, with electricity being 6.4 percent of the industry's value added (Ref. IV.2). The vast amount of energy use by this industry is for heating the kiln, but combustion of fossil fuels (primarily coal or gas) is used in this step (Ref. IV.18)*. As our case studies will show, the greatest portion of electricity usage is not for the kiln operation, but in the operation of the raw and finished cement grinders.

Lake Ontario Cement's Picton operation (located on the north shore of Lake Ontario) is the corporation's only cement manufacturing plant. As can be seen from the company's corporate structure in Figure IV-1, ready-mix concrete, concrete blocks, clinker, and other concrete products are marketed both directly and through several subsidiaries. In terms of dollar value of sales, standard portland cement is the predominant product, representing 77 percent of sales

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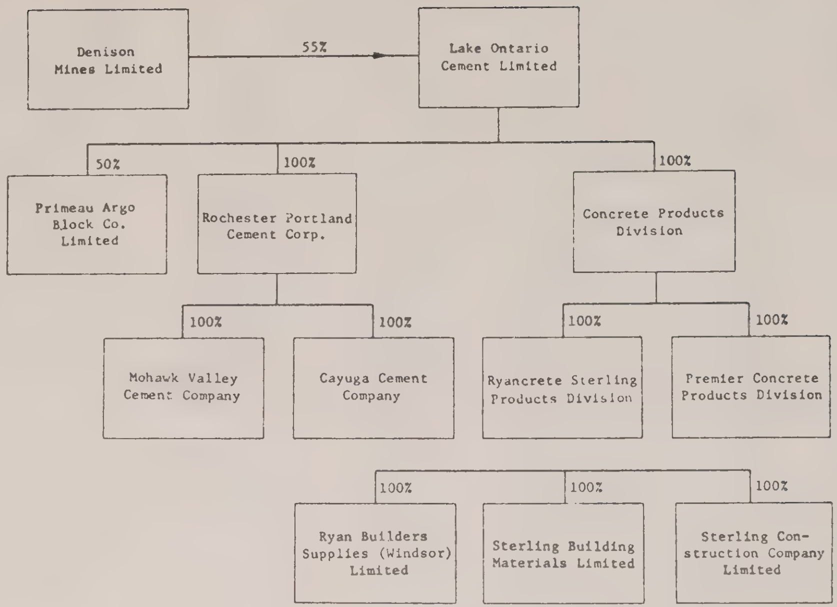
**Primarily because the slurry must first be dried by the kiln in the case of the "wet" process, this process requires approximately 20 percent more energy per ton of product than the "dry" process (Ref. IV.18).*

Figure IV-1

LAKE ONTARIO CEMENT LIMITED



SOURCE: Cement in Canada, Department of Energy Mines and Resources, Ottowa, 1973, pg. 98.

(Refs. IV.19, IV.20). Their cement products are marketed principally in Ontario and northern New York State (Ref. IV.21 Of the company's total 1974 sales, a relatively large portion, some 41 percent, was for export to the United States, (Refs. IV.19, IV.22).

In November of 1975, the company completed the second step in a three-stage expansion plan. A new kiln having an annual capacity of 850,000 tons of clinker per year was completed, thereby more than doubling the plant's 1974 capacity of 830,000 tons per year (produced by three smaller kilns). The third stage of the company's manufacturing expansion will be the addition of a 6,000 hp grinding facility in 1978 to produce cement from the new kiln's clinker. In the intervening period, the raw clinker is to be exported to the Cement Division of Martin Marietta Corporation at Essexville, Michigan (Ref. IV.20). As a result, the role of exports in the company's sales will increase in following years. In 1975, Lake Ontario Cement will represent approximately one-fifth of Ontario's production capacity (Ref. IV.16).

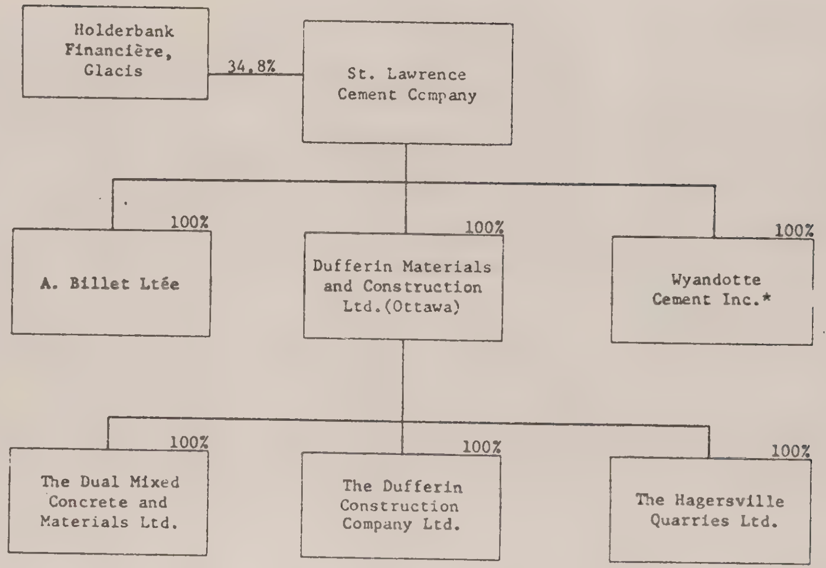
St. Lawrence Cement's Clarkson plant in Mississauga is one of two plants owned by the company, the other being in Villeneuve, Quebec. The Clarkson plant has a larger capacity, with 1,750,000 tons/year, or 69 percent of the firm's total (Ref. IV.17). The plant is 20 years old, and uses both wet and dry process kilns. All raw and finished grinding mills are ball mills. St. Lawrence is not an independent corporation, with a Swiss firm, Holderbank Financiere, holding the largest interest in the company (see Figure IV-2).* Figure IV-2 also shows that St. Lawrence's operation is vertically integrated selling cement products both directly and through subsidiaries.

St. Lawrence's predominant product is finished cement, which makes up 80 percent of total sales (primarily for domestic consumption). Clinker, some 20 percent of the plant's sales, is produced primarily for export. Total exports comprise approximately one-third of the plant's sales, of which 60 percent is clinker. Exports are totally to the United States, with major market areas in nearby Buffalo and Detroit (Ref. IV.23). In 1975, St. Lawrence Cement's Clarkson plant will represent approximately 30 percent of Ontario's total cement production capacity, remaining the province's largest cement firm (Ref. IV.17).

**The corporate structure of this firm has changed since this information was released, and this figure is therefore not completely accurate.*

Figure IV-2

ST. LAWRENCE CEMENT COMPANY



*St. Lawrence Cement Company, early in 1973, was ordered by the U.S. Federal Trade Commissioner to divest itself of Wyandotte Cement Inc.

SOURCE: Cement in Canada, Department of Energy Mines and Resources, Information Canada, Ottawa, 1973, pg. 100.

1. Rate Structure Impacts on Lake Ontario Cement

a. Scenario A. The doubling of electricity costs associated with Scenario A would not, in and of itself, incur a major hardship, or a decline in demand for Lake Ontario Cement's products. Still, it would make the firm more electricity intensive (as shown in Table IV-2).* Since all cement manufacturers in Ontario would be affected, the added costs could likely be passed through to domestic customers without a competitive disadvantage.** Electricity presently represents approximately 10 percent of total manufacturing costs, and a doubling would therefore incur on the order of a 10 percent rise in production costs (Ref. IV.24). The mining of the firm's raw materials is not very electricity intensive, and the cost of manufacturing inputs would not rise as a result of Scenario A. Electricity costs are but one of many other manufacturing costs, however. Although the electricity cost rise alone would not have severe implications, it is possible that this cost increase, when combined with other factors, could damage Lake Ontario Cement's market position.

During conversations with company representatives, it was pointed out that cement costs are not among the most critical in the construction process,*** and even a substantial rise in cement cost is not likely to reduce demand. Steel, an alternative construction material in some instances, might be able to cut into the cement market if cement product costs were to rise sharply. This is seen to be unlikely, however, as the use of cement in construction is not due only to its cost, but to the labor savings achieved in its use (e.g., through the use of prefabricated slabs) (Ref. IV.22).

Lake Ontario Cement, in light of its increasingly high percentage of exports, was seen to be in a better position than the industry as a whole to handle rising production costs in the face of the new wage and price

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* *Electricity-intensiveness in a manufacturing process is indicated by the cost of electricity taken as a percent of value added. Value added is found by deducting the cost of manufacturing materials, supplies, etc. and fuel and electricity consumed from the value of shipments (Ref. IV.2).*

** *A complication to this is the present wage and price control measure. The subject will be discussed later.*

*** *For example, only four percent of a new home's construction costs are for cement (Ref. IV.24).*

TABLE IV-2. SCENARIO IMPACTS ON LAKE ONTARIO CEMENT-1974

	Actual 1974 Rates	Scenario A 1978 Rates*	Scenario B 1978 Rates*
ELECTRICITY BILL	$892,754,75	$1,785,509.50	$2,313,090.70
ELECTRICITY AS A PERCENT OF VALUE ADDED IN PRODUCTION	9.1%**	19.4%	26.5%

* *Not accounted for in these estimates are any shifts in electricity use which might occur as a result of these electricity rate changes. Also, the Scenario B estimates assumes that bid-for interruptible power results in the same percent savings (17%) off of firm power costs as was the actual case in 1974.*

** *Source: Lake Ontario Cement's Census of Manufacturers, 1974 Statistics Canada Form CM-5-3304-38.1. Provided by Lake Ontario Cement.*

NOTE:

This table is not a projection to future years. It is a comparison for the business year 1974, considering only electricity cost increases.

controls. In the past, the U.S. Phase II price controls "kept cement prices artifically low" in the United States (Ref. IV.20), which was to the disadvantage of companies serving that market. Now, with Canadian controls, the situation will be reversed, and those companies which export should better be able to afford production cost increases such as electricity costs rises.* Lake Ontario Cement will be in an especially advantageous position in this respect, due to convenient transport locale and an existing U.S. sales network.

Lake Ontario Cement has several options by which to reduce future electricity costs in response to rate Scenario A. However, most of these steps seem improbable, either because they are not cost-effective overall, or because of their adverse market implications.

Over three quarters (79 percent) of this establishment's KWH usage is in the grinding steps of production, and, of this, some 70 percent is in the finished grinding step (Ref. IV.25). As such, grinding operations (especially the final grinding of clinker and gypsum) will be of the most importance in electricity usage shifts. One option to reduce this source of consumption is to employ roller mills instead of the conventional ball mills (roller mills being some 5 to 8 percent more efficient) (Ref. IV.24). This step has been taken by Lake Ontario Cement in any recent expansion of grinding capacity, and is planned for the large expansion in 1978. It would not, however, be cost effective to take their present ball mills out of service in favor of roller mills, due to the large capital investment required (the planned 6000 hp roller mill will cost on the order of 10 million dollars).

Another possibility to reduce electricity costs is through load management. Lake Ontario Cement's 1974 load factor was 78.6, relatively high when compared to other cement manufacturers,** but lower than some other major industries. Actually, Lake Ontario Cement's 1974 load factor (and electricity consumption) varied throughout the year, with the lowest load factor and consumption being experienced in January, and the highest in October. The seasonal nature of the construction industry (and therefore

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* *There may be some controls on exports, but this is not yet certain. It appears likely that "excess profits" will be taxed, unless they are reinvested by the company.*

** *The average load factor of cement firms served by Ontario Hydro was approximately 70 percent (Ref. IV.26).*

of cement demand) is the reason for this fluctuation. Lake Ontario Cement could, in order to reduce peak demand, build extra storage capacity so that additional winter production could be sold in the summer and fall, thereby reducing the peak. The company's policy in the past, however, has been, whenever given the choice of additional production capacity or additional storage capacity, to go with the production capacity. This decision is due primarily to high cost,* land use, and lack of flexibility incurred by a reliance on winter storage for future needs.

The single major step which Ontario Cement could take to reduce future electricity costs would involve the planned expansion in finished grinding capacity. This one step of cement production constitutes over half of the establishment's electricity consumption. Therefore, in light of Lake Ontario Cement's convenient transport locale, it is possible that the planned doubling of finished grinding capacity could occur outside of Ontario, possibly in New York State (where Lake Ontario Cement owns land and storage depots), or more probably in Quebec where relatively lower electricity costs might be obtained in the future. However, this step would be "tricky" with regard to the market, as the present Canadian market is centered largely in Ontario. In the future, however, Quebec may offer both lower electricity costs and a major cement market (Ref. IV.22). Therefore, while the step is plausible in the long term, it does not seem realistic in the time frame of the next few years.

Self-generation was also brought up as a potential alternative to paying increased Ontario Hydro rates. The firm already buys and stockpiles bituminous coal for use in its kilns, and so a fuel supply line is already established. This step seems improbable, however, due to the fact that it was felt that the initial capital investment required would be too large. Also, it was felt that such a proposition would be met with opposition by local residents, with whom the firm now has excellent relations (Ref. IV.24).

Finally, it was pointed out that the cement industry as a whole can take steps to educate the public in order to reduce electricity usage in cement production. Today, many consumers use a cement product's "Blaine Value"**

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* *New storage costs are approximately $100 per ton of added capacity (Ref. IV.24).*

** *Blaine Index is a measure of the total surface area of dry solids.*

as a determinant of which product to buy. As a result, producers grind their cement for a longer period of time in order to meet this demand for higher blaine values. Blaine value, however, does not have any relation to the performance of the cement in construction, and many consumers are evidently wasting their money and electrical energy by demanding the higher Blaine value (Ref. IV.24). Therefore, by educating the cement industry's consumers (most probably through the Portland Cement Association), the amount of electricity used in cement production could be reduced.

b. Scenario B. This rate structure, like Scenario A, is not expected to create a major hardship or a decline in demand for Lake Ontario Cement's products. However, as can be seen in Table IV-2, the potential for impact on the company's electricity bill (with no operational adjustments) is greater for this case. Certain responses to Scenario A, such as employing roller mills instead of ball mills, relocating the planned new expansion, and educational efforts, would also be applicable to Scenario B. But, because of this scenario's rate restructuring features, further measures are also possible.

The most probable response to Scenario B would be to switch some daytime grinding operations to the night shift (the firm presently operates three shifts continuously, seven days a week). This will be the most probable when the additional finished grinding capacity comes on line in 1978. It is expected that less than half of this capacity will be needed for normal operations at that time due to clinker sales (Ref. IV.24). Therefore, by reducing grinding during the day, the excess capacity could be used to produce portland cement at a high level during the off-peak hours (when their kilowatt peak would not be measured under Scenario B)*. This, then, is one operational measure that Lake Ontario Cement would be likely to take to reduce Scenario B's impact.

As an extension of the above concept, it was considered whether increasing capacity still further to grind only at night would be feasible. A rough calculation of the electricity savings achieved through this measure indicated that it would take on the order of 30 years to pay back the initial investment for another 6000 hp grinder (10 million dollars). The normal pay-back period on investments

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It should be noted that it is the daytime-only peak measurement which encourages this step. The 1.5 mill peak/off-peak differential was not considered large enough to be a factor.

considered tend to be more on the order of five years or less, and further increasing grinding capacity for this purpose does not seen to be economically feasible (Ref. IV.24).

The bid for interruptible power option might well hurt Lake Ontario Cement. Presently, Lake Ontario Cement buys over three quarters of its electricity at reduced interruptible rates. Ontario Hydro's excellent record of very infrequent interruptions was cited as the reason for purchasing this type of power. Their operation could only stand a maximum interruption of four hours duration, and only infrequently (due to a lack of raw storage capacity)* (Ref. IV.24). They have been buying a large amount of interruptible power, then; not because they are able to be interrupted, but because this type of service is presently not interrupted nearly so often or so long as the interruptible power contract allows. With bid-for power (being priced according to realistically estimated interruption probabilities), it is therefore possible that Lake Ontario Cement would not obtain its present discount at acceptably low probabilities of interruption.

2. Rate Scenario Impacts on St. Lawrence Cement

a. Scenario A. Since Scenario A would impact all of Ontario's cement producers, it was felt that there would be very little impact on St. Lawrence's domestic market (the largest segment of their sales).** In terms of exports, however, sales could be hurt if comparative price increases are not experienced in the U.S. Electricity costs, it was pointed out, are presently on the order of St. Lawrence's profit margin in the Buffalo market area. A doubling of electricity costs, then, could make the company non-competitive in this market area (Ref. IV.23).

St. Lawrence's operational options by which to react to Scenario A include: switching from ball mills to roller mills, load management, and self-generation of electricity. Both self-generation and a switch to roller mills

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* *The problem here is that the kiln must be kept operating, and, although emergency power would keep the kiln turning, ground raw materials must continue to be fed into it. Shutting it down could damage the kiln (Ref. IV.24).*

** *The recent wage and price controls were not mentioned as being of major concern in relation to passing on the increased production costs.*

were not seen to be cost-effective. Also, it was stated that the firm is in the cement business (not the electricity business), and is therefore not at all interested in self-generation (Ref. IV.23).

Load management to reduce seasonal peaks was considered a plausible step for a cement firm. Storage capacity of the excess final product made during off-peak months is what is required. In St. Lawrence's particular situation, such a step was out of the question, however, as approximately two years ago the firm chose to increase grinding capacity to meet peak demand needs, instead of building storage capacity. Therefore, the option of seasonal load management is also not of interest under this rate Scenario (Ref. IV.23).

As discussed previously, St. Lawrence also has a cement operation in Quebec. Because of this fact, the company has the option of developing new capacity at either the Ontario or Quebec sites. In the short term, it seems unlikely that the company would place new capacity in Quebec, due to the high cost of transporting the cement to the major U.S. and Canadian market areas in and around Ontario. However, it was pointed out that St. Lawrence's fossil fuel costs are lower in Quebec* and that, if electricity costs should become lower in Quebec than Ontario, it is quite possible, in the longer term, that these two factors could make it cost-effective for new expansion to occur at the Quebec site rather than in Ontario (Ref. IV.23).

b. Scenario B. Scenario B's 1978 rates would result in a 17 percent higher electricity bill than Scenario A for present usage patterns (see Table IV-3). Unlike Scenario A, however, it presents St. Lawrence with some very viable options to cope with the rising rates.

The aspect of Scenario B which is of the most interest to St. Lawrence is bid-for interruptible power. In the past, they (as a municipal utility customer) have not had the option of buying interruptible power** As part of Scenario B, all large electricity consumers (over 3000 KW peak demand) can bid for interruptible power at discounted

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* *It is uncertain that this is the rule throughout the Province of Quebec, however.*

** *Due to the municipal utilities' charters, only Ontario Hydro's direct customers have, until recently, had the option of buying interruptible power. Apparently, many municipal customers are not aware that they can now purchase interruptible power.*

TABLE IV-3. SCENARIO IMPACTS ON ST. LAWRENCE CEMENT - 1974 ELECTRICITY USE

	Actual 1974 Rates	Scenario A 1978 Rates*	Scenario B 1978 Rates*
ELECTRICITY BILL	$1,654,615	$3,309,230	$3,879,960
ELECTRICITY AS A PERCENT OF VALUE ADDED IN PRODUCTION	7.8%**	17.0%	20.4%

**Not accounted for in these estimates are any shifts in electricity use which might occur as a result of these electricity rate changes. Also, the above Scenario B estimate assumes no rate reduction from the use of interruptible power, which St. Lawrence does not presently buy.*

***SOURCE: St. Lawrence Cement's Census of Manufacturers, 1974, Statistics Canada From CM-5-3304-38.1. Provided by St. Lawrence Cement.*

NOTE:

This table is not a projection to future years. It is a comparison for the business year 1974, considering only electricity cost increases.

rates. St. Lawrence is presently in the process of assessing the feasibility of using interruptible power, but, initially, it is estimated that about half of their power use could be interrupted for up to eight hours, several times per year (Ref. IV.28). One complication to this option is that the opinion was expressed that, since they must be able to meet their consumer's needs during peak construction times (primarily August and September), their ability to accept interruptions would vary seasonally (Ref. IV.23).

Electricity bill savings could also be obtained from the lengthening of the peak demand measurement period. Presently, the 15 minute demand measurement used to bill customers does not give them time to react to errors in load management. A lengthening of the averaging time would, it was felt, give them more time to react and lower their demand charges (Ref. IV.23).

St. Lawrence Cement could also take advantage of Scenario B's daytime peak measurement aspect. It was believed that, though production could not be shifted so as to be constant throughout the year, it would be possible to increase grinding operations at night, while reducing daytime operations. The net result being the same daily production with a reduced electricity cost (Ref. IV.23).

Finally, Scenario B does not include the stipulation that the customer pay, at minimum, a certain percentage of that customer's peak demand over the last 11 months. St. Lawrence presently pays, under the demand portion of their bill, at least 75 percent of the maximum demand peak incurred over the last 11 months of service. Since they are a seasonal producer, they many times have paid a greater charge for the demand portion of their bill than they actually incurred in that particular month.* The elimination of this stipulation, combined with the many new options opened up by Scenario B, will encourage St. Lawrence to take significant steps to adjust their operations so as to reduce their electricity bills.

3. Impact Summary

In the short-term (during the late seventies), the impact of Scenarios A or B on the domestic cement industry will apparently be small, with the increased production costs being passed on to the consumer with no significant demand decline or employment effects. The export market, however, is less certain, and will vary from company to

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**It should be noted that it was felt that this stipulation has also led to wasteful use of electricity on off-peak months.*

company, depending primarily on present market positions. Some apparently will stay competitive, while others may not be able to compete with U.S. firms for that market as the combination of transportation costs and rising electricity costs could make such firms' products too expensive . Although the impact of these rate scenarios on domestic cement demand is expected to be small, their effect on exports is unsure. In general, however, the immediate economic importance of electricity costs to cement firm seems small compared to other factors (e.g., firm location with respect to market).

Scenario A and Scenario B differ in that Scenario B, while it may initially mean higher rates than Scenario A, will allow the cement companies to reduce their electricity costs by adjusting their operations in ways which are cost-effective. The firms seem to have made all the changes they can make within the present rate structure, and the only alternative to Scenario A is to locate new expansion outside of Ontario (which is not presently viable from a marketing standpoint). Scenario B, however, allows cost reductions through day-to-night shifts in grinding operations, a lengthening of the peak demand measurement, the elimination of a minimum peak demand payment, and by offering interruptible power to those municipal customers who, in the past, could not purchase it.

Probably the most interesting output from these case analyses of the cement industry is in terms of the bid-for interruptible power option. On one hand, the case of Lake Ontario Cement points out that certain establishments which presently buy interruptible power are buying it even though they may not actually be able to afford interruption. It has essentially been firm power at reduced costs. Hence, past experience in Ontario with interruptible power is probably not indicative of the response which this option will receive. On the other hand, the case of St. Lawrence Cement points out the fact that there are potential buyers not now purchasing interruptible power. They will, under Scenario B, become bidders for the available blocks of interruptible power. The actual market response to this bid-for interruptible power is therefore very uncertain.

The case of St. Lawrence Cement also points out another factor important to interruptible power. Seasonal industries, such as the cement industry, can more afford to be interrupted at certain times of the year than others. This being the case, these industries will have difficulties in using interruptible power unless interruption probabilities can be given (or can be agreed upon) for various times of the year.

The long-term implications to Ontario's cement industry of rising electricity costs in Ontario, though less certain than the short-term, appear to be more significant than the short-term impacts. If electricity costs in Ontario do, in fact, rise as projected by these rate scenarios (and if they are significantly above those experienced in Quebec), it may be profitable for future expansion by the Canadian cement industry to shift to Quebec. If this were to occur, many jobs (both directly and indirectly tied to the cement industry) would be lost from Ontario in the future. Developments in the cement industry should therefore be carefully monitored over time in order to determine the actual potential for such a shift in industry production and employment.

D. Steel Industry Case Study: Lake Ontario Steel Company, Limited

The vast majority (over 75 percent) of Canada's steel production capacity is located in Ontario, where market proximity, abundant raw materials, and relatively inexpensive power have existed (Ref. IV.29, IV.30). Iron and Steel Mills are among the province's more electricity-intensive industrial sectors, with electricity representing 3.5 percent of the industry's value added in 1972 (Ref. IV.2). Steel production is achieved using one of three types of furnaces: (1) the Open Hearth Furnace (some 31 percent of Canadian production in 1973), (2) the Basic Oxygen Furnace (BOF) (the favored type in recent expansion, representing some 61 percent of production in 1973), and (3) the Electric Furnace (a small but growing portion of the industry which made up eight percent of the 1973 steel production) (Ref. IV.30). Since electric furnaces, by their nature, are the most electricity-intensive type of steel production* (and therefore will likely be the most severely impacted by rate increases), this type of steel production was investigated.

Electric furnaces have been used in the past largely for the production of alloy steels, primarily because electric heating does not impart impurities to the steel. In the last decade, however, electric furnaces have become economical in producing certain standard steels as well. The electric furnace can use a 100 percent scrap iron, or can

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**Electricity makes up an average of 40 percent of the total ingot production energy use in electric steelmaking, versus four percent in both open hearth and BOF steelmaking (Ref. IV.30).*

also accept reduced iron. As a result, electric furnaces are very flexible in their use, and produce a high quality steel (Ref. IV.31).

Electric steelmaking involves four basic steps. First, the furnace is "charged" with steel scrap or reduced iron. Carbon electrodes are then lowered into the furnace. Current arcs from one electrode to the charge to the next electrode, thus melting the charge. Third, limestone and flux are charged on top of the molten bath, causing impurities to form a slag on top of the metal. The furnace is then tilted, and the slag removed. Finally, when the composition of the steel meets desired specifications, the furnace is tilted so that the molten metal pours out for casting (Ref. IV.31).

Lake Ontario Steel (LASCO), located in Whitby, Ontario (on the northern shore of Lake Ontario) is the largest electric steelmaker in Ontario (with 325,000 tons/yr furnace capacity in 1973, or 34 percent of the total Ontario electric furnace capacity) (Ref. IV.30). The Whitby plant is 12 years old, and has two continuously operating electric arc furnaces (on three eight-hour shifts). This "mini steel plant"* also has a steel rolling mill in which the furnace's cast billets are made into various steel products (primarily structural shapes). The plant makes only limited amounts of specialty alloy steels, instead producing (from scrap) those conventional steel products for which there is a demand.** (Ref. IV.32). Presently, 65 percent of LASCO's sales are inside Ontario, with the remainder of sales split between the Quebec and U.S. markets (Refs. IV.32, IV.33). The firm has no self-generation, electricity being bought "direct" from Ontario Hydro. The overwhelming majority (82 percent in 1974) of electricity usage at the plant is by the electric arc furnace (Ref. IV.34).

1. <u>Rate Scenario Impacts</u>

a. <u>Scenario A</u>. The major factors to the continuing profitability of electric "mini-steel mills" such as this one are the price and availability of both scrap iron and electricity (Ref. IV.30). The market price of standard

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* *Though the largest electric steelmaker, LASCO is small when compared to conventional Open Hearth or BOF plants.*

** *It is the flexibility of electric furnaces which allows LASCO to make shifts in their product line so as to produce those steel products which are in demand at any one time.*

steel products (such as made in this plant) are set by the larger manufacturers. As long as the price of scrap and electricity is low enough so that electric steel mills can stay under the major producers' price, LASCO can turn a profit. Such a business is very cyclical, however, some years being excellent and others very marginal. Scrap costs (amounting to as much as 50 percent of total manufacturing costs) are probably more important than electricity costs to a firm of this nature, but, in a marginal year, electricity could be a decisive factor (Ref. IV.35). In fact, during discussions it was stated that, at these higher rates, LASCO might very well have gone out of business in past years (Ref. IV.32). Clearly, Scenario A's rate change decreases LASCO's chances of staying profitable in the future.*

The inherent flexibility of electric furnaces does give the producer a great variability in the type of steel that can be manufactured. Therefore, one option LASCO has to cope with rising electricity costs is to switch to more profitable steels. This can only be done within limits, however, due to melting process restrictions and because the mill portion of LASCO's operation is tooled only to certain product lines (requiring considerable capital investments for major changes) (Ref. IV.32).

Rising electricity costs may also affect LASCO's plans for expansion. LASCO is presently considering a doubling of its furnace capacity in the next few years (Ref. IV.32). If electricity rates were to double by 1978, however, it is possible that the expansion might not occur, or, more likely, that it would occur elsewhere. The corporation which owns LASCO also owns a plant in Sheerness, England, as well as another in Texas (Ref. IV.36). New expansion could, therefore, occur at one of these other sites, rather than in Ontario if electricity rates were to rise (relatively) higher.** In fact, LASCO's parent company is not limited to these sites alone, and is actively studying locations in several parts of the world in order to operate at sites which are advantageous in regard to all factors (Ref. IV.32).

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* *Aside from increasing operating costs, rising electricity rates will also increase LASCO's iron scrap costs, as well, since their scrap is shredded (using electrical power) in Ontario (Ref. IV.32).*

** *It is interesting to note that most of the electric furnace capacity increases in Canada in recent years have occurred outside Ontario, in Quebec and the Western Provinces (Ref. IV.30).*

The loss of existing or future steel production at Lake Ontario Steel would affect both industrial and secondary employment in the local Whitby area. A closure of the plant would result in a loss of over 700 industrial jobs, while a change in present plans to double capacity would probably mean a reduction of potential employment on that order of magnitude as well. Moreover, many secondary jobs in service areas such as schools, hospitals, theaters, and restaurants would also be impacted by a loss of LASCO's input of both industrial wages and taxes to the community. Therefore, any loss of industrial jobs as a result of rising production costs will be of broader economic significance (on a local level) than industrial employment alone.

b. Scenario B. The impacts of Scenario B on Lake Ontario Steel will be of the same nature as Scenario A's impacts. The rate restructuring aspect of Scenario B, however, will cause its impacts to be still greater unless cost-cutting operational adjustments (made possible by the rate restructuring) take place. For example, had Scenario B's 1978 rates been in effect in 1974, Lake Ontario Steel's annual electricity bill would have been 3.5 times higher than it actually was. This result might be unexpected, as Lake Ontario Steel's low load factor (48 percent in 1974) (Ref. IV.34) should cause LASCO to be positively affected by a rate structure which puts less accentuation on the demand portion of the bill. LASCO, however, presently has especially low "electric furnace" rates. Therefore, due to the fact that Scenario B would equalize rates provincewide, such "electric furnace rates" would be abolished, thereby causing a more than tripling of LASCO's rates by 1978.

Lake Ontario Steel would not benefit by the peak/off-peak rates or the bid-for interruptible power options of Scenario B. It is because of the capital intensiveness of the steel business that this is true. LASCO presently must operate at peak capacity in order that production pay for overhead expenses. LASCO, therefore, could not afford to let any furnace capacity stay idle during the day. At the same time LASCO would not be able to buy high-risk interruptible power to offset the elimination of special "electric furnace" rates, since frequent interruptions would ruin profitability* (Ref. IV.32).

LASCO presently buys 100 percent of its furnace power as interruptible. As the above discussion revealed, however, LASCO cannot afford to be interrupted due to the

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It was roughly approximated that, for each day LASCO might be shut down, there would be on the order of a $100,000 loss to the company (Ref. IV.32).

huge losses which would be incurred. Therefore, LASCO does not buy interruptible power because of the operation's capability to be interrupted, but instead because Ontario Hydro's past record of interruptions is so excellent. The case of Lake Ontario Steel points out, then, that many firms which presently buy interruptible power do so, not because they can afford to be interrupted, but because of Ontario Hydro's recent history of few, if any, interruptions.

It should also be noted that Lake Ontario Steel representatives were suspicious of the bid-for interruptible power option, and expressed concern about possible inequities inherent in a bidding system. It is feared that a bidding system will lead to a loss in stability of both electricity supply and cost. LASCO will be active in discussions of this option, as well as the electricity price increases, both individually and through the Association of Major Power Consumers of Ontario (AMPCO) (Refs.IV.32, IV.35).

2. Impact Summary

The analysis of this case study indicates that the impact of electricity rate increases on electric steelmaking firms may be significant. The market price of their product is set by the major steel producers, and are not related to the electric steel firms' manufacturing costs (much of which are electricity and scrap). Rising electricity rates will increase not only these firms' electricity bills, but also the price of feedscrap (which is shredded using an electricity intensive process). If the manufacturing costs of firms such as LASCO rise above the major producers' costs, then they will be forced out of the market. Clearly, rising electricity rates will impact the steel industry as a whole, but, in the case of electricity steelmakers, rising rates may progressively decrease the viability of future operations.

E. Retail Chain Store Case Study: Marks and Spencer

In 1973, annual chain sector sales (excluding department stores) reached a total of $4.4 billion in Ontario, or 30% of the total retail market (Ref. IV.37). In order to study possible impacts of electrical rate level and rate structure changes on this important economic sector, the retail company "Marks and Spencer" was chosen for case analysis. More specifically, the company's store situated at 193 Yonge Street, Toronto, was studied in detail. This store is served by a municipal utility, Toronto Hydro.

With the recent take-over of People's Department Stores, there are now 75 Marks and Spencer stores throughout Canada, with approximately 50 of these in Ontario. Out of these 75 stores, 23 are known as St. Michael stores, while 52 presently carry the name of Walkers stores. These stores deal with soft goods only (i.e. mainly family clothing with some food items). Most of the stores' clothing has the St. Michael brand name, a line of products of superior quality which thus sells at higher than average prices. The St. Michael line is of British origin, and 95% of the present items are manufactured in Great Britain. In fact, Marks and Spencer is a British based company, where it operates over 250 stores.

The store located at 193 Yonge Street, Toronto, is owned and operated by St. Michael shops which in turn is owned by Marks and Spencer. The store, which was opened in November 1973, is located in an old 7-storey building. Because of the building's poor condition, the top four floors are left vacant, with only the first two floors being used for sales area. The third floor is used for office space, while the basement is for storage.

The store sells mainly St. Michael family clothing products at prices set nationally by the head office. Since its opening, sales have been somewhat below predicted levels. However, the completion of a nearby major retail complex in 1976 is expected to improve the situation by increasing population concentration. Also, it is normal for a retail store to be unprofitable for the first two or three years of operation (Ref. IV.38). The decision to open a new store can be a long-term investment, and most store leases are for 20 to 25 years.* Some company officials stated that even stores that have been unprofitable for a number of years are often kept in operation for marketing purposes.

The building's electricity use for the past 12 months is shown on Table IV-4. The total hydro cost for the period August 1974 to July 1975 was $14,796, which represents 1.93% of the store's total expenses (Ref. IV.39).

The store uses electricity to operate one elevator, two escalators, and an electric bailer. The escalators are switched off after store hours. The bailer is presently used whenever excess garbage is collected. Lights are another major source of hydro consumption. Fluorescent lights are used for the peripheral system (i.e. along the walls), while mercury vapour lights are used for the sales

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* *The Yonge Street Store presently has a 25 year lease.*

TABLE IV-4. ELECTRICITY USE AND COSTS-MARKS AND SPENCER

Month	Demand (KW)	Consumption (KWH)	Load Factor	NET BILL $
August 1974	232	87,600	52	1,258.16
Sept.	216	77,200	49	1,151.89
Oct.	216	78,000	49	1,125.75
Nov.	216	69,200	44	1,115.89
Dec.	200	80,400	55	1,234.61
Jan. 1975	200	93,200	64	1,304,63
Feb.	192	81,600	58	1,206.46
Mar.	176	77,600	60	1,122.44
April	192	73,200	52	1,281.82
May	216	71,200	45	1,236.53
June	232	82,400	49	1,362.67
July	224	93,200	57	1,395.54
Total	2512	964,800		14,796.00
Avg/month	209	80,400	53	1,233.00

Rate Structure -

Toronto Hydro's Industrial Power Rate
$1.48/KW
2.98 cents/KWH for 1st 100 hrs. of billing demand
1.05 cents/KWH for 2nd 100 hrs. of billing demand
.65 cents/KWH for the balance

area, basement storage room, and office space. Office and basement lights are turned off after hours, and so are most lights on the sales floor. Only the peripheral lights are left on overnight to comply with fire and safety regulations. In fact, lights in this store can be used very efficiently due to the numerous switches in the building. The sales floor lights are turned on in sequence to minimize demand load. The canopy lights* and the neon sign are switched on from 8:00 a.m. to 12:00 p.m. The store makes no use of illiminated displays (not even during the Christmas season), nor is the building electrically heated (Ref. IV.40).

The main user of electricity is the air-conditioning system, which services 25,000 square feet (the 2 sales floors and the office floor). Floor temperatures (which can be controlled individually) are usually set in the 68 degree - 72 degree range.

**The canopy lights consist of twelve 150 watt spotlights.*

Other uses of electricity include ventilation, water heating, cooking (in the cafeteria), and business machines. All machines are turned off after hours because of fire regulations.

In total, the building has a fairly constant billing demand and KWH consumption from month to month. Its day-time hours of operation result in a load factor which ranges from 44% to a high of 64%.

1. Rate Scenario Impacts

a. Scenario A. As per Scenario A, the building's rates would increase 90 percent by 1978, and 200% by 1983. The resulting costs would be as follows (under the assumption of similar consumption patterns for all years):

	1975	1978	1983
Electrical cost/month	$1,233	$2,243	$3,699

These rate increases would not necessarily result in higher electrical costs as a percentage of total expenses. Other expenses will also increase, and Marks and Spencer might be able to conserve on its electrical consumption.

Marks and Spencer is very strong on energy conservation. The company's chairman is constantly quoted in Britain on conservation matters, and the British government is using some of the company's achievements in this field as models for other enterprises. The company is already endeavouring to conserve energy by:

(1) Turning off lights in stockrooms etc. when not in use

(2) Reducing lighting during non-business hours down to emergency lighting

(3) Turning off elevators etc. during non-business hours (Ref. IV.39).

As mentioned previously, the Yonge Street store has already implemented most of these procedures. However, these conservation measures are difficult to implement in other stores, especially for those located in shopping centers or malls where the controls (i.e., light switches, thermostats, etc.) are centralized for all stores.

Since Marks and Spencer is in the retail business, they are unable to take the following steps:

(1) Relocate their stores

(1) Relocate their stores
(2) Alter hours of usage to non-peak periods
(3) Reduce light levels, unless all other competitors did the same. One of their selling points is "bright and clean"
(4) Turn off certain services (such as escalators) during off-peak store hours, due to the overriding importance of good service (Ref. IV.39).

Because of the long-term nature of retail store investment decisions, Marks and Spencer would not consider relocating its existing stores. However, drastic rate level changes might influence the investment decisions concerning new stores. This is rather unlikely though, since the market potential usually dictates the location of new stores.

Even though it is impossible to shift the store's hours, Marks and Spencer could still reduce electricity costs through wise load management. For example, prohibiting the use of the electric bailer during peak hours could reduce billing demand.

Under Scenario A rates, Marks and Spencer would seriously endeavour to:

(1) Increase thermostat settings in summer to reduce hydro usage for air-conditioning units. Present settings at the Yonge street store of 68-70°F could easily be increased without undue discomfort. Again, the problem of centralized control units in shopping centers compounds the problem;
(2) Better insulate buildings; and,
(3) Add door entrances to prevent heat losses in winter and gains in summer (Ref. IV.39).

With this type of operation, the store's electricity load level will not increase over that used at present, as the consumption is expected to either remain constant or decrease (depending on the success of new conservation measures). Hence, the store's hydro costs should not increase by more than the figures shown at the beginning of this section.

Higher hydro costs could also affect Marks and Spencer indirectly through higher costs for clothing manufacturers. Although most of its garments are presently manufactured in Britain, the trend is for Canadian retailers to produce their own items. Electricity has, traditionally, made up only 0.19% of product value for clothing manufacturers in

Ontario (Ref. IV.2). Hence, higher hydro rates would not put much pressure for higher wholesale clothing prices, and should not reverse the trend for Marks and Spencer to buy from Canadian manufacturers.

Companies such as Marks & Spencer will be faced with several alternatives:

(1) Absorb the cost increases;
(2) Absorb the cost increases, but reduce expenses in other areas, notably personnel. At the Yonge Store, 37% of operating costs are for personnel (40 people on the payroll). To cut down on expenses, Marks and Spencer could switch from a service store to a check-out operation where less personnel are required (Ref. IV.39, IV.41).
(3) Increase prices.

By 1978, all other costs will have risen to some degree, so it is difficult for management to forecast the course of action they could be forced to take. This problem is also compounded by the fact that prices at Marks and Spencer are set nationally, a practice which isn't expected to be modified.

b. Scenario B. The store at 193 Yonge Street falls into the 50-3000 kw electricity user class. The resulting electrical costs for the store, assuming similar consumption patterns for each year, would be as follows:

	1975	1978	1983
Electrical cost/month	$1,233	$2,570	$4,036
% increase	0	108%	227%

Hence, the impact is slightly greater under Scenario B as compared to Scenario A. With a load factor of 53%, one would expect Scenario B to have less of an impact*. The incongruity can be explained by the fact that Scenario B standardizes rates for all municipalities and all customers, whereas present 1975 rates vary from place to place (and also vary according to the consumption level). This is in constrast to Scenario A, where present 1975 rates are simply increased by a certain percentage. Hence, generalizing from an individual comparison between the two Scenarios can be misleading.

**The average load factor for commercial establishments was assumed to be 60% in determining Scenario B rate structures, based on past Ontario Hydro experience.*

Other stores serviced by Toronto Hydro which have a higher load factor (but a similar consumption level) would suffer even higher cost increases under Scenario B as compared to the Marks and Spencer store. For example, stores that have illuminated window displays that are left on overnight, or who presently carry out some operations at night, might be hit with even higher hydro rate increases unless time-of-day rates were extended to the 50-3000 KW customer class. Marks and Spencer (and other stores with similarly efficient operations) would most probably gain a slight competitive edge under this second Scenario.

The observations outlined in the previous section also apply under this Scenario. As for any operational or technical changes, these would again be similar to those already mentioned. Finally, retail stores like Marks and Spencer (which have summer peaks because of air-conditioning) would benefit from seasonal rates due to their corresponding lower summer demand charges.

2. Impact Summary

Electricity costs represent about 2% of total expenses for the Marks and Spencer store at 193 Yonge Street, Toronto. Hence, hydro rate increases would have limited impacts on this store. The impact would be greater on other retail stores which, in contrast to Marks and Spencer, make extensive use of illuminated displays, spotlights, etc. In fact, Marks and Spencer seems to be very energy conscious, and one can expect new conservation measures or retrofit devices as electricity costs increase.

Stores such as Marks and Spencer would, in general, be better off under the new D/E split because of their low load factor. Retail stores have very little flexibility in their hours of operation, which makes it very difficult for them to improve their load management. However, they are able to take steps to reduce total electricity consumption. Hence, the advantage of the Scenario B D/E split.

Increased rates would mainly have an impact on direct operating costs. Indirect impacts through higher wholesale prices should be minimal, as electricity has traditionally made up only 0.19% of product value for family clothing. As for relocation of stores, this is almost infeasible for existing stores because of the long-term investment nature of the retail business. As for new store location, market potential is usually the deciding factor.

Higher hydro costs might result in budget cutbacks in other items, mainly personnel. Increasing operating costs could result in more check-out stores (as opposed to the present service stores). The other alternative is to pass higher costs on to the customers via increased retail prices. The decision is compounded for Marks and Spencer, as their prices are set nationally. Thus, higher Ontario energy costs might be partially passed on to residents of other provinces.

F. Office Building Case Study: Prudential Assurance Building

To study the impact of major electrical rate structure and rate level changes on an office building, the complex situated at 141 Adelaide Street West, in the city of Toronto, was selected. The building was chosen as being representative of a middle-size, fossil-fuel heated, office tower of recent construction.

The 17-storey office tower at 141 Adelaide Street West is managed by Paramet, a wholly owned subsidiary of the Prudential Assurance Company (which owns the building and occupies about one fifth of the total office space). This precast concrete building was completed in December 1973, and was managed by A.E. LePage until January 1975, when Paramet took over ownership and management. As of November 1975, 105,000 sq. ft. (or 57%) of the 184,000 available square footage had been leased to 12 various commercial establishments, including the Prudential Assurance Co. The leases are for 5 years, and the majority will be expiring in 1980 (Ref. IV.42).*

The Prudential Buildings office space is of Class A, meaning that all modern facilities (including air conditioning) are available. Rates charged by Paramet are somewhat lower than those charged for other comparable office space in downtown Toronto. The reasons given for this situation are: (1) it cannot match the prestige of some of the better known, large office towers, or the extensive services they provide; and (2) it was built several years ago (when construction costs were lower). Because of it's lower rental charge, Paramet hopes to achieve 75% occupancy by the end of February 1976, and close to full occupancy by the end of 1976.

**Except as noted, this interview is the basis of all data presented for this case study.*

The office building is heated primarily by gas, which also provides the energy for hot water. The lighting is designed to produce 75 foot candles at desk level, in an open area, on a maintained basis. Lights are turned off during weekends, and at about 10:00 p.m. workdays (at which time the cleaning staff has completed its tasks). Electricity is also required to operate six elevators which service the building, and to operate the building's ventilation system (external ventilation is turned off at night).

The cental air-conditioning system is a major source of electrical consumption, causing electricity demand to peak during the summer months. The system was designed to maintain the building temperature at about 75° F year-round, with 50% relative humidity during the summer. However, tenants can (and do) adjust the temperature to their own individual needs, since control valves and thermostats are provided every 20 feet along the peripheral system. In fact, it has been found that tenants tend to set the controls at about 72° F.

The building's monthly demand, consumption, and load factor are listed in Table IV-5. The total net bill is obtained using Toronto Hydro's Industrial Power Rate Schedule.* From Table IV-5, we observe that the air-conditioning system causes the summer billing demand to be almost twice the winter value, and results in a summer load factor which ranges between 60 and 70 percent. The average net bill for the past 12 months was $5,866 per month, or about 25% of operating costs under full occupancy.

This building's consumption of 5.2 million KWH per year seems to be fairly average for office buildings of its size. The typical breakdown of KWH usage for an office tower is as

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* *Toronto Hydro's 1975 Industrial Rate Structure was as follows:*
$1.48 per kW of the billing demand
2.98 cents per kWh for the first 100 hours of the billing demand
1.05 cents per kWh for the next 100 hours of the billing demand
0.65 cents per kWh for the balance of the monthly consumption

Net billing is obtained by subtracting 10% for prompt payment.

TABLE IV-5

PRUDENTIAL ASSURANCE BUILDING COSTS

Month	Billing Demand (KW)	Billing Consumption (1000 KWH)	Net Bill (Dollars)	Load Factor	Percentage Occupancy
Jan. 1974	530	352.8	3,312.96	91.2	21
Feb	576	364.8	3,782.59	86.6	21
Mar	530	295.2	3,299.90	76.3	21
Apr	530	333.6	3,572.70	86.2	21
May	1056	304.8	5,296.75	39.5	21
June	1056	367.2	5,577.55	47.6	21
July	864	484.8	5,393.09	76.9	21
Aug	864	429.6	5,144.69	68.1	21
Sept	864	360.0	4,831.49	57.1	21
Oct	816	300.0	4,383.07	50.4	21
Nov	864	283.2	4,485.89	44.9	21
Dec	523	280.8	3,226.18	73.5	21
Jan.* 1975	624	384.0	4,610.74	84.3	35
Feb	672	348.0	4,582.01	70.9	35-51
Mar	672	448.8	5,171.69	91.5	35-51
Apr	1008	460.8	6,514.99	62.6	35-51
May	1104	513.6	7,187.62	63.7	35-51
June	1056	465.6	6,724.94	60.4	35-51
July	1104	544.8	7,370.14	67.6	35-51
Aug	1056	547.2	7,202.30	71.0	35-51
Sept	1056	528.0	7,089.98	68.5	51
Oct	960	441.6	6,220.80	63.0	54
Total (For last 12 months)	10,699	5,245	70,392		
Monthly Avg (For last 12 months)	892	437	5,866	67	

* *Paramet took over management.*

Source: Toronto Hydro Billing Data, 1975.

follows (Ref. IV.45):

	KWH/gross sq ft/yr
Lighting	12
Ventilation	7-8
Air-Conditioning	5
Elevators and Pumps	2-3
TOTAL (doesn't include office machines)	26-28

1. Rate Scenario Impacts

a. Scenario A. Based on this scenario, the Prudential Building's rates would be 1.9 times 1975 rates in 1978, and 3 times 1975 rates in 1983. This would result in an average monthly increase of \$5.279 in 1978 and \$11,732 in 1983 (under the assumption of identical electrical consumption for every year).*

If one compares the building's electrical consumption for the first ten months of 1974 (when 20% of floor space was rented) to the first ten months of 1975 (when average occupancy was about 40%) one notices a 20% increase in KW demand and a 30% increase in KWH consumption. Comparisons between these two years can be misleading, though, because Paramet took over management in 1975. Also, electrical consumption is not expected to increase though 5 of the 17 floors are completely unoccupied at the present time, because the whole building is air-conditioned, ventilated, and heated. The centralized system design makes this mandatory. Secondly, it is important to maintain vacant office spaces in good condition for promotional reasons. Lights on these vacant floors are also left on. A higher occupancy rate would certainly mean a heavier load due to typewriters, photocopying machines, etc. However, the tenants do not make use of electricity intensive machinery, and this is not expected to change in the future. Also, a higher load due to increased occupancy can be partly offset by conservation measures and better load management (more will be said on this in following discussions). Summing up, one can expect load profiles to change in magnitude and shape in the future, but not drastically.

**This assumption seems questionable in one respect. In the base year (Nov. 1974 to Oct. 1975), the building's occupancy rate ranged from 21% to 55%, while the owners expect a much higher occupancy rate in the future.*

The higher costs from Scenario A would certainly exert some pressure on the building's rent charges. Paramet leases office space for a "basic rental rate" plus an extra charge to cover the cost of "individual" electrical consumption used for lighting, office equipment, etc. Note that this special electrical rate is identical for all tenants. The amount charged by Paramet was found to cover costs fairly closely, and is believed to be below the average charged by many office towers. In leased office space, higher electrical costs can be immediately passed on to the tenants, since the leases have built-in escalator clauses (which allow for higher rates if operating costs increase). Under the assumption of identical load profiles, 1978 rental rates would increase by 34 cents per square foot per year, and by 76 cents in 1983. These would result in approximately 3.6% and 8% higher rents in 1978 and 1983, respectively, over average 1975 base rates.

A building which has a low vacancy rate will be minimally affected by higher electrical rates in the short run (most leases include escalation clauses). Paramet, however, is in a difficult position because of its high vacancy rate. For example, assume that electrical rates increase by 20% in 1976. Prospective tenants are apt to demand 1976 as a base year in calculating escalating costs, which would cause Paramet to suffer severe losses in its profit margins unless it raises its base rental rates. Paramet is reluctant to increase its base rates because of the strong competition it faces.* Thus, 1976 rate increases might be passed on only to the present tenants, allowing 50 percent of the cost increase to be internalized. When it is considered that electrical costs make up over 25% of the operating costs** for the Prudential building, one realizes that major rate increases might result in significant reductions in the profit margins of office buildings which have high vacancy rates, depending on other factors such as vacancy rate for office space in the vicinity.***

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* *Numerous office buildings are under construction in the vicinity, with some nearing completion.*

** *Based on present 1975 rates and <u>full</u> occupancy.*

*** *Thus, the only direct impact of increased rates is on operating costs. A "soft" market, however, may result in reduced profit margins.*

For office buildings which have close to full occupancy, increased hydro rates coupled with market conditions could have a more long-run impact on their profitability. Since most office leases are for five years, the typical lease period remaining at a given time would be of two and one-half years. As the leases expire, new rates must be negotiated. These new rates might incorporate part or all of electrical cost increases, being subject to: (1) the state of the market (i,e., vacancy rate) and (2) the relative cost increases of a particular building as compared to the increases which its competition will face.

The impact of higher electrical rates could be still worse for electricity heated office towers which consume an average of 40 to 50% more KWH in comparison to non-electrically heated buildings. Hence, Paramet might find itself benefiting in the long-run from higher rates. This, of course, depends on the comparable costs of other substitute fuels. A delphi forecast, prepared as part of the Impact Study at Ontario Hydro (Ref. IV.44), predicts the following increases for oil and gas as compared to a 1975 base year:

Year	Oil	Gas	Electricity (as per Scenario A)
1975	100	100	100
1978	156	164	190
1979	181	194	
1983	265	288	300
1984	286	311	

Thus, if 1978 electricity rates do increase by 90% over 1975 rates (as per Scenario A), then oil and/or gas heated office towers would see their competitive position improved by 1978. By 1983 though, gas increases will almost catch up to electricity increases, with oil not too far behind. However, the latest developments (i.e., 22% increase in bulk power rates for 1976) seem to indicate a one year lag in electricity rate increases. That is, Scenario A electrical rates for 1978 and 1983 will actually be in effect in 1979 and 1984. If this continues to be the case, then gas, oil, and electricity prices may increase at very similar rates. Hence, the competitive position of office buildings heated by different energy sources may not change.

Higher rates will certainly add incentives for reduced electrical consumption, and for better load management. However, the nature of Paramet's operations restricts any flexibility in its energy consumption and demand.

The air-conditioning system is a major user of electricity, and it is also the main cause for high summer peak demand. In order to reduce this peak demand, the management started, in the summer of 1975, to leave the chiller on at a low level overnight, instead of the old practice of turning it off at night and setting it to a maximum in the morning. Whether this new approach resulted in a smaller demand is questionable if one examines Table IV-5 closely. Also, on hot summer days, the chiller must be left on overnight of necessity to maintain office space at a comfortable temperature and to protect the system from overloading for long periods of time.

As for reducing electrical consumption, the alternatives are restricted by the importance of premium service for the tenants. Because of the adequate supply of office space in downtown Toronto, Paramet is obliged to offer whatever services its tenants require in order to maintain a good reputation. Thus, management can't realistically order the tenants to set the air conditioning at the optimal 75°F. As for lighting, 75 foot candles is average or less for office space.

As costs increase, Paramet might consider providing its tenants with "conservation" information on the importance of higher temperature set points in the summer, etc. This approach would be considered only if escalating operating costs resulted in a number of complaints from tenants on escalating rents. Again, the importance of good service makes this alternative unattractive at the present time (Ref. IV.46).

Finally, no hardware retrofits are being considered. Nevertheless, the building's superintendent expects improvements in efficiency by modifying the present system in order to meet the individual requirements of those tenants which make use of various floor layouts.

b. Scenario B. This scenario would result in average monthly increases to Paramet of $5,627 by 1978 and $13,774 by 1983 over the 1975 monthly average of $5,866. Again, identical electrical consumption patterns for every year are assumed. These increases are higher than those obtained from Scenario A. The 1978 increase is $348 more a month, while the 1983 increase is $2,042 more. Under Scenario B, the 1978 rates are 1.96 times 1975 rates, while the 1983 rates are 3.35 times 1975 rates. Hence, Scenario B has more impact on Paramet than Scenario A (due largely to Paramet's relatively high, 67 percent, load factor).

If all electricity cost increases are passed on to the tenants, rents would increase by 37 cents per square foot per year in 1978, and by 90 cents in 1983. Percentage wise, these represent increases of approximately 3.9% and 9.5% in 1978 and 1983, respectively, over average 1975 base rental rates.

As mentioned previously, Paramet is limited in the various operational changes it can implement to reduce its electrical costs. Again, let us look at the air-conditioning operation. Under Scenario B, Paramet might be better off shutting off the chiller at night in order to save on energy. However, this might not be feasible during warm summer days because of system limitations. Once more, one must stress the importance of good service, and its overriding influence on operations.

The management doesn't see itself making use of individual rates for tenants based on the amount of office equipment in use. None of the building's present tenants use electrically intensive equipment, and the situation is not expected to change in the future.

A most efficient way of promoting energy conservation from tenants would involve using individual metering in future office buildings. However, a Midwest Research Institute study in the United States has shown that few office towers make use of individual metering because of required flexibility in rental space and lighting requirements for maintenance (Ref. IV.48).

Secondary impacts should have minimal consequences on the Prudential building's operations. Paramet does not lease to electrically intensive establishments. Hence, industry relocations should not be of major importance. Higher wholesale prices for building supplies due to increasing hydro rates might, however, have some impact on the building's operating costs.

Finally, two other pricing concepts could serve to dampen the impact of rate increases on Paramet. First, if time-of-day pricing was extended to the 50 to 3000 KW customer class, then the costs of providing air-conditioning could be reduced because of lower night-time KWH rates. As mentioned above, the chiller must sometimes be left on overnight because of system limitations. Also, Paramet could reduce its billing demand by causing the chiller to peak before 7 AM when demand is not metered. Secondly, seasonal rates would benefit Paramet since the air-conditioning system results in summer peaks.

2. Impact Summary

Electricity costs under Scenario A and B could result in the following rental rate increases if all costs are passed on to Paramet's tenants via escalator clauses:

	1978	1983
Scenario A	3.6%	8%
Scenario B	3.9%	9.5%

However, the Prudential Assurance building is almost half vacant, and the tough competition might force Paramet to absorb some of the costs associated with higher electrical rates. The impact could be important since electrical costs represent over 25% of the building's operating costs. If Paramet has to internalize all rate increases, then the figures shown above represent decreases in their profit. Even the profitability of fully occupied buildings could be affected in the long-run when leases expire and new rates must be negotiated, depending on the state of the office space market in the future.

Paramet is severely restricted in any operational changes due to the nature of its operations and the importance of premium service. On the other hand, the management and staff are fairly inexperienced in the operations of this building because of the recent take over. Experience and better load management procedures should result in some technical and operational changes that could cut down on electrical consumption.

G. Hospital Case Study: Toronto General Hospital

At the end of 1973 there were 234 public hospitals, 31 private hospitals, 12 federal hospitals and 26 nursing homes in Ontario. The total number of beds available in all hospitals under the Ontario Health Insurance Plan numbered 51,402 of which 48,853 beds were in public hospitals. (Ref. IV.49). Public general hospitals made up 62 percent of all hospitals in Ontario in 1973 (Ref. IV.50). Of these, some 73 percent had lay ownership.*

The gross operating costs for public hospitals increased by 9.1 percent to $1,179 million in 1973 while the total Ministry financial responsibility increased by 7.5 percent

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**A lay hospital is one which is operated by a non-government non-religious, non-profit corporation, association, or society.*

to $933 million. These increases were due, in part, to the initial operating costs for three new hospitals. Total full-time personnel in hospitals was 89,282, while part-time personnel amounted to 19,215 (Ref. IV.49).

The budgetary procedure for public hospitals is a complex one, and is liable to change from year to year in accordance with new Ministry policies, availability of funds, etc. In recent years, the Ministry has been using "global" budgets which involve an across-the-board percentage increase based on variables such as annual inflation rates and cost of living rises. The opposite procedure consists of a "line" budget where each item in the budget is studied and approved individually. In the future, the expectation is for a mix of global and line budgets. (i.e. across the board percentage increases with the hospitals' base to be revised every 3 years). The next few years are expected to be "hard ones" for hospitals, as the Ministry is trying to cut back on escalating budgets. In 1975, all hospitals were required to cut back their escalated budget by 2 percent (Ref. IV.51).

Funds for capital expenditures are obtained from the Ministry of Health as well, but these funds are also expected to be difficult to obtain in the future. Hospitals do not normally borrow on the money market. Thus, availability of funds represents a constraint on energy use decisions, especially since the Ministry has no formal program for capital expenditures that save on operating costs.

Toronto General Hospital, chosen for the specific case study, is a public hospital with lay ownership, and has had the typical "sprawl" development.* Toronto General is the third largest hospital in the province, based on number of beds (1,102 in 1973), but its budget is by far the largest. Its 1973 gross operating costs amounted to $46,663,467. A breakdown of operating costs are shown in Table IV-6, along with comparable data for other hospitals. The hospital, in 1973, received 95 percent of its funds from the Ministry of Health.

The hospital's facilities and offices are located in a number of buildings, some of which are quite old (the hospital was established in 1819). The main wing is 15 stories high and was completed in 1957. Total floor space is presently 1-1/4 million square feet. However, the hospital has planned

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**Most hospitals have started with a single building, and, instead of relocating, have added new wings or constructed buildings adjacent to the original.*

Table IV-6

Distribution of Hospital Costs on a per Diem Basis - 1973*

	Toronto General Hospital	Percent Breakdown	Average of all 236 Ontario Public Hospitals	Percent Breakdown
Salaries and Wages	$ 92.25	67.8	$56.37	68.5
Medical and Surgical Supplies	5.62	4.1	2.47	3.0
Drugs	4.36	3.2	2.10	2.5
Administration	10.21	7.5	6.04	7.3
Food-gross cost	2.75	2.0	2.29	2.8
Laundry and Linen	2.34	1.7	1.30	1.6
Housekeeping	.35	0.3	.48	0.6
Plant operation (including electricity costs)	2.56	1.9	1.70	2.1
Plant maintenance	1.78	1.3	1.13	1.4
Depreciation of shareable equipment	2.33	1.7	1.54	1.9
Building depreciation and interest	2.65	1.9	1.86	2.3
Other (allowable)	8.13	6.0	4.22	5.1
Other (non-allowable)	.56	0.4	.80	1.0
Gross Operating Costs	$135.89	100.0	$82.30	100.0

Costs per "total active patient days."

a major expansion in the form of a 475,000 square foot complex with a tentative completion data in 1981 (construction to start in summer of 1976). The Ministry has allocated $25 million for the new building. Since some of the older buildings will be disposed of, the new complex is expected to result in a net increase of about 225,000 sq. ft. (or 20 percent), with a decrease in the number of beds from the present 1,100 to 1,000. A decrease in beds is forecast for most downtown hospitals in major Ontario cities (Ref. IV.52).

The hospital's main users of electricity are the air-conditioning system, the elevators, and the kitchen. Table IV-7 shows the institution's consumption and demand patterns for the past 12 months. The average monthly demand and consumption were 2,624 KW and 1,307,600 KWH respectively. The nature of the hospital's operations results in a fairly high load factor which ranges from a low of 70% to a high 85% (Ref. IV.45). Approximately 80% of its electrical costs are for energy charges, and 20% for demand.*

The hospital is heated by steam, which it receives from the Toronto Hospital Steam Corporation. In 1975, the plant is expected to sell 850,000 million pounds of steam to the nine establishments which it services. The plant's main energy source is gas, but it also uses oil and electricity, with its total electricity bill for the last 12 months being $29,234 (Ref. IV.45). The steam corporation is also under the responsibility of the Ministry of Health. Its costs are allocated to the various institutions it services on a pro rata basis. In the past few years, Toronto General has consumed approximately 25 percent of the plant's steam output. Thus, the hospital's total electrical costs for the past 12 months amounted to $181,868 + (.25 x 29,234), or $189,177. This total represents less than one percent of the hospital's total operating costs.

1. Rate Scenario Impacts

a. Scenario A. Under this scenario, the hospital's purchased electricity rates will be 1.9 times the 1975 rates in 1978, and 3.0 times the 1975 rates in 1983. These rates would result in the following costs as shown in Table IV-8.

Because of Toronto Hydro's rate structure, the demand influences the energy rate. Thus, the two components cannot be isolated from each other.

TABLE IV-7

ELECTRICAL CONSUMPTION AND COSTS IN 1975 FOR TORONTO GENERAL HOSPITAL*

Month	KW Demand	KWH Consumed	Load Factor	Net** Billing Amount
October	2121.6	1,113,600	.72	$11,641.32
November	2121.6	1,180,800	.76	11,914.24
December	2208.0	1,377,600	.85	15,138.96
January'75	2208.0	1,132,800	.70	13,819.15
February	2208.0	1,272,000	.79	14,569.64
March	2208.0	1,185,600	.74	14,103.79
April	2208.0	1,142,400	.71	13,870.88
May	2495.0	1,430,400	.78	16,429.28
June	2784.0	1,420,800	.70	17,383.19
July	2880.0	1,588,800	.76	18,624.17
August	2856.0	1,526,400	.73	18,203.94
September	2592.0	1,320,000	.70	16,169.29
TOTAL	28,890	15,691,200	---	$181,868
Avg.	2,624	1,307,600	.75	$15,156

* *Does not include electrical consumption and costs for the steam plant.*

** *The present rate structure is as follows:*
$1.48 per KW
2.98 cents for first 100 hours of billing demand
1.05 cents for second 100 hours of billing demand
.65 cents per KWH for the balance
(10% deducted for prompt payment)

TABLE IV-8. TORONTO GENERAL'S ELECTRICITY COSTS UNDER SCENARIO A

	1975	1978	1983
Hospital Yearly net bill	$181,868	$345,549	$545,604
Hospital Average Monthly bill	15,156	28,796	45,467
Steam plant yearly net bill	29,234	55,545	87,702
Steam plant average monthly bill	2,436	4,629	7,309
Total yearly net bill	$211,102	$401,094	$633,306
Total average monthly bill	17,592	33,425	52,776
Total percentage increase	---	90%	200%

These cost figures are based on the hospital's 1975 load profile and energy consumption. This is not an accurate projection of costs in 1983, however, due to the new complex. Actually, costs will rise more rapidly, as the new complex will (when completed in 1980) add 20 percent to its floor area and will make use of central air-conditioning. The new building is also expected to increase the hospital's peak demand, as it will offer daytime ambulatory health care service (Ref. IV.51). In light of these facts, on the order of a 20 percent increase in energy consumption and a 25 percent increase in demand is projected for 1983. Under these new assumptions, Toronto General Hospital's electrical costs would be the following in 1983 (the complex does not affect 1978 costs, since it will not be completed before 1980):

TABLE IV-9. HOSPITAL ELECTRICITY COSTS WITH NEW COMPLEX: 1983

Average monthly Hospital KWH	1,569,120
Average monthly Hospital KW	3,280
Average monthly Hospital Bill	$64,824
Average monthly Steam Plant Bill	7,309
Average monthly Electricity Costs (Total)	$72,133
Annual Electricity Cost (Total)	$865,596
Percent Increase Over 1975	310

Under Scenario A, the hospital would benefit by reducing its billing demand. The institution's peaks occur between 7 and 8 o'clock in the morning, with the summer peaks being higher than winter peaks because of air-conditioning. The air-conditioning is presently left on 24 hours a day to cut down peak demand. This procedure would certainly be maintained under Scenario A (Ref. IV.53).

The nature of a hospital's operations leaves little flexibility in improving load management. Centralized and poorly controllable systems hinder conservation efforts, as do government regulations on variables such as ventilation and temperature. Few services, if any, would be eliminated or performed at alternate times, as proper patient care is a much more important factor than electricity costs.

Certain procedures are now in use to save energy, with more possible in the future (as hydro rates increase). The engineering department has recently picked up on maintenance in order to reduce fuel costs. Also, a survey is presently being conducted throughout the hospital to reduce inefficient lighting. Fluorescent lights have recently been ordered to cut down on energy consumption. In short, the engineering department is certainly cost conscious, and more conservation measures are to be expected as electrical costs rise.

The incentive for hospital's to conserve on energy greatly depends on the budgetary process, since they are non-profit organizations which lack the classical profit motive. The "global" budget presently in use should, theoretically, increase motivation for energy conservation. Under this type of budget, cost savings in one department result in more money for other operations. Hence, the incentive for reduced electrical costs. Under the traditional "line" budget, a hospital's reductions in electrical costs could have resulted in budget cutbacks for the following year.

A main barrier to the implementation of any major retrofit conservation device(s) is the availability of funds. As mentioned earlier, funds are extremely difficult to obtain for hospitals, even if they are for projects which would result in significant cost savings. The proposed complex is a good example. Since construction has not yet started, the hospital is in good position to install new conservation devices, or sophisticated system designs that reduce energy requirements. However, the new building must not exceed $25 million in capital costs, and extra funds from the Ministry are doubtful. Thus, a sophisticated system design might mean less funds for other important capital outlays. Obviously, this problem poses a barrier to any use of new conservation devices.

As electricity costs rise, the hospital could consider generating its own electricity through the steam plant. The steam would serve the dual purpose of generating electricity and heating the hospital. Again, the need for capital funds (and its lack of availability) would probably make this endeavour impossible. Moreover, the steam plant

has been under some severe criticisms from pollution control groups, and any permit for expansion would be difficult to obtain. Finally, escalating gas costs make the project even less attractive, as gas increases are expected to rise commensurate with electricity increases: (Ref. IV.44).

Since close to 70 percent of the hospital's budget is for labour, any increase in electrical costs might have an effect on manpower if higher hydro rates are not compensated for in the budget. By 1978, the hospital's electrical costs might increase as much as $200,000 over its 1975 figure. If no corresponding budget increases are allowed, this could result in a staff reduction of 10 semi-professional employees (Ref. IV.51). The hospital's electrical costs may increase by $654,500 by 1983. Again, under the "worse situation" scenario where no corresponding budget increases are allowed, the hospital's staff might be reduced by 33. Reductions in staff may, in turn, affect the quality and quantity of services provided at the hospital.

b. Scenario B. The hospital's average monthly billing demand in 1975 was 2,624 KW. According to the previous section's forecast, average monthly demand for Toronto General Hospital would be similar in 1978, but would increase to 3,280 KW by 1983. Hence, this hospital falls under two different customer classes for Scenario B.

TABLE IV-10. TORONTO GENERAL'S SCENARIO B ELECTRICITY COSTS

			1983	
	1975	1978	Without New Complex	Including New Complex
Yearly net steam plant bill	$ 29,234	$ 61,897	$ 97,165	$ 97,165
Yearly net hospital bill	181,868	387,615*	608,329	819,960**
Annual Total	211,102	449,512	705,394	917,125
Total Percent Increase	0	113	234	334

Clearly, Scenario B has more of an impact on the hospital's electricity cost than Scenario A, with total electricity costs for the hospital increasing by 12 percent over Scenario A in 1978, and 6 percent in 1983 (with the new complex).***

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* *Rates for 50-3000 KW customer class used.*

** *Rates for 3000 KW customer class used.*

*** *The reason for this decline in the percent differential between Scenario A and B in 1983 is the change in Toronto General's customer class in 1980 (when the new complex is complete).*

The impacts of these higher costs of the hospital's operations will, again, depend greatly on the budgetary procedure that the Ministry of Health adopts in the future. As compared to Scenario A, Scenario B's rate structure could result in a further decrease in staff by 2 or 3 semi-professional workers under the "worse situation" (where the budget is maintained at 1975 levels for electrical costs).

Other concepts built into Scenario B might, however, dampen the impact on the hospital. Peak/off-peak rates would help Toronto General Hospital through its lower energy charge at night. If one assumes that 25 percent of the energy is used between 11:00 PM and 7:00 AM, then a .15¢/KWH differential would result in savings of about $2,000 per month (assuming 1975 energy consumption). The hospital could also save through peak/off-peak pricing if it could shift its peak to sometime before 7:00 AM when demand is not metered. However, system limitations and the importance of good patient care could make this alternative impractical. Also, present air-conditioning is provided by numerous individual window units which makes centralized control almost impossible. However, the new complex at Toronto General Hospital could be desigend so as to take advantage of Scenario B's pricing mechanisms. Finally, since the hospital's electricity demand peak occurs in the summer, the implementation of seasonal rates is an option which could help Toronto General in offsetting rising rates.

2. Impact Summary

A study of Toronto General Hospital enables one to draw some general observations on how Ontario Hospitals would react to major rate level and rate structure changes. Electricity represents a small portion of a hospital's total operating budget (less than 1%, in this case). Also, any hospital's main objective is to provide the best possible patient care. The combination of these two facts has traditionally caused hospital administrators to give load management a low priority. Administrative attitudes towards electricity usage may change in the very near future as hydro rates increase, and as hospital budgets are severely reduced. The adaptation of global budgets which involve across-the-board escalation increases should promote still more incentive for efficient overall energy management. On the other hand, the nature of a hospital's operations severely limits the alternatives open for energy conservation and improved load management. A lack of capital also restricts hospitals from installing expensive retrofit conservation devices. The age of numerous hospital buildings would make the installation of new machinery or new environmental systems difficult and expensive. Among Scenario B's pricing options, it appears

that peak/off-peak rates could be taken advantage of by the hospital, especially in the case of the new complex. Seasonal rates were also noted as a pricing policy which would be advantageous to Toronto General.

The main impact of higher hydro rates may be to the personnel employed by hospitals. Labour costs represent on the order of 70% of a hospital's budget. In the case of Toronto General Hospital, it was found that the projected rate increases could result in lay-offs in semi-professional staff if the hospital budget allocation for electricity remained at the 1975 level (Ref. IV.51). Alternatives to personnel or service cut-backs include rising costs to the public, in the form of either increased taxes or insurance premiums, or cut-backs in other government budgets.

H. Apartment Case Study: One Fountainhead

To study the impact of major electrical rate structure and rate level changes on a multi-family dwelling, the apartment building situated at One Fountainhead Road (in the Borough of North York) was selected. The building was chosen as being representative of a large-size bulk-metered, fossil-fuel heated apartment building.*

This building, completed in 1971, is 22 stories high and contains 370 units. The apartment units, together with the common areas, add up to 330,988** square feet of floor space. The units range from bachelors to three-bedroom apartments, and are rented mainly to families in the middle income bracket.

This apartment building is, and always has been master-metered. The main uses of electricity are for lighting and cooking (with each apartment having its own stove and refrigerator). The building is not electrically heated, and makes no use of central air-conditioning. Some electricity for the common area is required for hallway lighting, elevators, laundry room, and for the ventilation system. Since the

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* *In 1974, there were approximately 350,000 bulk-metered apartment units in Ontario, of which 81 percent were fossil fuel heated.*

** *The gross square footage is thus 895 per suite, very close to the province's average of 900 sq ft per suite for apartment buildings.*

building provides underground parking to its tenants, electricity is also required for the cable-heated ramp. Individual dishwashers or dryers are prohibited, but air-conditioning units are allowed at no extra cost. The building's total electrical consumption and demand requirements for the past twelve months are shown on Table IV-11, along with the net bill charged by North York Hydro, which services this building (Ref. IV.54). The building's hydro electricity bill for the last 12 months amounted to $34,613 or $93.55 per suite per year (with an approximate 45/55 demand-energy cost split). For 1974, its total hydro bill was $32,240, as compared to $35,440 for fuel costs.* Hence, hydro represented 48 percent of the building's energy requirements (on a cost basis), and 3.5 percent of the total operating costs for this building in 1974 (Rev. IV.55).

The building's average monthly load factor was 54 percent. This seems to be representative for an apartment building of this type because of the high day-time peaks and low night-time energy requirements. In studies conducted by Ontario Hydro on various apartment buildings, it was found that the domestic service loads generally peak at about 5:00 p.m., with the maximum demands occurring in December and January (Ref. IV.56).

The building's yearly KWH consumption per suite was 6,328 for the past 12 months, or 7.07 KWH/square foot/year. These figures seem to be fairly average (or even above average) consumption for this type of building.

The building is owned and operated by Cadillac-Fairview, a company engaged in most phases of real estate development in seven provinces in Canada. As of February 1975, the Residential Group of the company operated a number of apartment buildings which had a total of 15,228 suites, with most of them being in Toronto. As of March 31, 1974, approximately 98 percent of the suites were leased (Ref. IV.57). Note that the apartment building at One Fountainhead was also chosen for the study on the basis of individual data availability (many apartment buildings owned by Cadillac-Fairview are grouped together for accounting purposes).

As of October 1975, the building was experiencing an abnormally high vacancy rate of 3.7 percent (Ref. IV.58). This phenomena is the result of direct competition of some three other nearby apartment buildings which were very recently built by Cadillac-Fairview itself. In the future,

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**The building makes use of a dual (gas-oil) fuel heating system, and uses gas to heat the water.*

TABLE IV-11

ELECTRICITY USE AND COST FOR ONE FOUNTAINHEAD

Month	Consumption (KWH)	Demand (KW)	Load Factor (%)	Net Bill*
Nov 1974	184,000	512	49.2	$2,525.20
Dec	225,600	560	55.2	3,062.48
Jan 1975	196,600	576	46.6	3,150.20
Feb	206,400	568	49.8	3,221.72
March	188,000	536	46.2	2,906.44
April	233,600	520	61.5	3,341.08
May	163,200	480	46.6	2,621.56
June	184,000	424	59.5	2,664.60
July	203,200	432	64.4	2,853.56
Aug	224,000	448	68.5	3,076.60
Sept	159,200	424	51.4	2,436.36
Oct	173,600	448	53.1	2,633.08
Avg/month	195,117	494	54.3	2,884.00

** Obtained by using North York's "general service" retail rates:*

5.20 cents for the first 50 KWH
2.35 cents for the next 200 KWH
1.96 cents for the next 9,750 KWH
.88 cents for the next 1,900,000 KWH
.50 for any additional KWH

this rate is expected to decrease to a "normal" level. This building is presently subjected to rent controls, as are all other apartments in Ontario.

1. Rate Scenario Impacts

a. Scenario A. Under Scenario A, the building's hydro rates would increase over the 1975 rates by 90 percent in 1978, and by 200 percent in 1983. The resulting costs per suite per year are shown in Table IV-12, under the assumption of similar consumption patterns for all years.

TABLE IV-12. BULK-METERED APARTMENT BUILDING ELECTRICITY COSTS UNDER SCENARIO A

	1975	1978	1983
Cost/suite/year	$93.55	$177.73	$280.65
Annual percent increase over 1975	---	90	200

Management at Cadillac-Fairview has already anticipated major rate increases for all types of energy sources, and thus has begun to study numerous energy-saving devices, procedures, and systems.* In fact, the engineering department expects major savings through an energy program developed by Consumer's Gas. This study, which is heavily subsidized by the Federal Department of Works, makes use of a complex computer program to simulate all of the building's operating and energy requirements. The program is new, and Cadillac-Fairview is probably the only Ontario developer which is making use of it at the moment.**

This program could result in energy savings of 25 percent, or more, over present consumption rates for house services, according to Mr. McConnell of the engineering division (Ref. IV.59). For example, it was found that some buildings' hot water systems are 100% overdesigned, while some heating systems are 50% overdesigned. Charges in these

* *Hence, the expectation of higher rates in the future may cause actions and impacts to occur in advance of rate increases, as well as afterwards.*

** *The study will not, however, improve the company's competitiveness in the long-run, since most of the information will quickly become public, and any new procedures or systems may be adopted by other developers as well.*

systems would have secondary impacts on hydro consumption (e.g., less electricity needed to pump the water). One of the most promising hydro savings involves the operation of the ventilation system. Corridor ventilation (or pressurization) is necessary during the day-time to contain odors within individual suites, but, at nighttime, tenants do not make much use of cooking facilities and odors are minimal. Thus, the corridor ventilation can be reduced at night. Cadillac-Fairview is considering a 50 percent horsepower reduction for its ventilation system for 12 night hours. However, this procedure might increase peak demand. Under the Scenario A rate structure, then, the nighttime savings in energy might be more than offset by an increase in cost due to higher daytime demand.

Along the same line of thought, it was found that kitchen and washroom ventilation systems are overdesigned and overused. The Consumers' Gas energy program is causing management to question standard system specifications which have traditionally been proposed by contractors. Many of these specifications have no cost/benefit analysis to support them, something which the simulation model can provide. This brings to light a second-order impact on suppliers of ventilation equipment, who might have to redesign their systems for cost-conscious customers.

Under Scenario A, an apartment building would benefit greatly if it could increase its load factor. For example, an all-electric building* could use "load controllers" which automatically regulate energy consumption so as to minimize the peak demand. At a cost of about $2,000 plus installation fee, these controllers could result in major cost reductions for certain buildings under Scenario A. However, a building such as One Fountainhead can hardly gain by making use of a load controller because of the lack of flexibility in the electrical services it provides. For example, electric water heaters can be controlled so as to minimize an all-electric building's peak demand, whereas a building with limited electricity-intensive devices cannot benefit from such diversity. Hence, an all-electric building might initially be harder hit by fast rising hydro rates, but wise load management can cushion the impact. Even under present rates, all-electric apartment buildings have load factors in the middle 60's (Ref. IV.56) (as compared to 54% for One Fountainhead). The net effect on the competitiveness of a building such as One Fountainhead really depends on the relative costs of other fuels such as gas and oil, and these are expected to rise approximately commensurate with electricity (Ref. IV.44). As a result, with proper load management all electric buildings may remain competitive under Scenario A.

**An all-electric building here is an apartment building which makes use of electricity for space and water heating.*

In discussions with One Fountainhead's management, it was noted that the higher rates under Scenario A would generally hurt smaller size bulk-metered apartment buildings more severely. The greater the number of suites, the higher the load factor (because of increased diversity). Hence, a smaller bulk-metered building with a lower load factor could suffer some competitive disadvantages as electricity rates increase with the existing D/E ratio.

Increased electricity rates would also cause management to review the lighting system. Landscape lighting could be reduced, but with an indeterminant effect on real or imagined occupant security. Corridor lighting, however, is a service that must be provided. Timers have been tried for corridor lighting, but were later removed because of numerous tenant complaints.

In a further effort to achieve optimal load management in its various buildings, Cadillac-Fairview makes use of seminars to educate its building engineers. The firm also uses such tools as "heating performance graphs" to measure building efficiency and to promote constructive internal competition among its engineers for best performance.

The greatest use of hydro originates from the individual suites. Cadillac-Fairview has hardly any control over this consumption. However, management could exert some sort of indirect control by making use of surcharges for special electricity-intensive devices used by tenants (e.g., individual air-conditioners). This has been tried before, but administrative costs outweighed the savings. Higher hydro rates could certainly make this practice profitable. Management could also try to influence its tenant's energy consumption patterns through an internal conservation promotion campaign. The success of such an approach is almost impossible to forecast, as it has not been tried previously. Consumption could be reduced by switching to more efficient or gas consuming appliances, but high initial costs make this option infeasible. As for resident parameters such as family size, management has little control.

With these factors in mind, one can estimate the building's energy consumption in 1978 and 1983, and thus assess the impact of higher hydro rates. Assume for the domestic load that the consumption pattern will not change greatly by 1983, since the tenants have no great incentive to conserve energy when bulk-metering is used. Next, assume a 25 percent energy reduction for "house" services (Ref. IV.55). To obtain forecasts of the building's energy consumption based on these

assumptions, one must first estimate what percentage of total load is used for house services. Very few surveys have attempted to estimate the breakdown of total load into house and domestic loads. A 1970 survey carried out by Ontario Hydro showed that, in apartment buildings with 150 or more suites, about 50 percent of total KWH consumption was for "house" loads not associated directly with individual apartment units. The survey reported a 68 percent load factor for "house" load, and a 41 percent load factor for domestic, or individual apartment unit, load. Together, these result in a 54 percent load factor. Thus, the apartments surveyed were similar to the one being studied in this case. Because of increasing saturation of residential electrical appliances, assume that house load accounted for 40 percent of total load for One Fountainhead last year.*

The forecasted load pattern for 1978 and 1983 are shown below, along with the associated costs due to Scenario A rates. (Table IV-13)

TABLE IV-13. INDIVIDUALLY-METERED APARTMENT BUILDING ELECTRICITY COSTS: SCENARIO A

	1975	1978	1983
House load - KW	157	115	115
- KWH/Month	78,047	58,535	58,535
Domestic load - KW	337	337	337
- KWH/Month	117,070	117,070	117,070
Total - KW	494	452	452
- KWH/Month	195,117	175,605	175,605
Electrical costs/suite/year	$ 93.55	$163.96	$258.88
Percentage increase over 1975	---	75	177

Whether these increases would be directly passed along to the tenants or not depends on many interrelated factors such as rent controls, housing starts, and competition. For example, rent controls could force landlords to internalize a larger portion of electricity cost increases than would be the case in a free-market situation.

Recent studies by Ontario Hydro's Power Market Analysis branch also give support to this estimate.

b. Scenario B. The apartment building at One Fountainhead falls under the 50-3000 KW customer class. Assuming 1975 consumption patterns, its hydro costs for 1978 and 1983 would be as shown in Table IV-14.

TABLE IV-14. BULK-METERED APARTMENT BUILDING ELECTRICITY COSTS UNDER SCENARIO B

	1975	1978	1983
Cost/suite/year	\$93.55	\$182.30	\$286.18
Annual Percent Increase Over 1975	--	95	206

As expected, the building's low load factor causes Scenario B to have results similar to that of Scenario A.* Under this scenario, approximately 65 percent of electricity costs are due to the "energy" portion of the bill, versus 55 percent under present North York rates. Thus, energy consumption would be a more important cost factor (as opposed to demand). Hence, this scenario could result in cost savings if the ventilation system was cut back by 50 percent for 12 hours at night, as mentioned under Scenario A. All-electric buildings would necessarily be hardest hit under Scenario B since their diversity advantage is partly reduced. On the otherhand, small bulk-metered buildings would gain under this rate scenario,as their lower load factors would not result in higher relative costs.

Under Scenario B, bulk-metering of some existing multifamily dwellings could be prohibited to discourage energy waste. A study by MRI in the United States demonstrated that, on an average, KWH consumption for master-metered dwelling units averaged 34 percent higher than comparable dwelling units with individual metering (Ref. IV.48). Individual metering, however, involves high initial costs. Retrofit wiring costs can range from \$100 to \$1,200 per dwelling unit, depending on the age of the building and the type of wiring presently installed (Ref. IV.48). Most of the buildings owned by Cadillac-Fairview have always been master-metered, and thus were not wired for individual metering. At One

The buildings load factor would, in general, result in slightly lower rate increases under Scenario B. However, this is offset by the Fact that North York's General Service rates are lower than the Ontario Hydro 3-phase general service rates, which were used in determining Scenario B rates.

Fountainhead, feeders and control boards are located on every third floor. Individual metering would thus result in very expensive wiring costs.* The management also feels that individual metering would be difficult to achieve, as all available space has been optimally allocated. The problem is further compounded by the fact that the present trend is toward bulk-metering, as certain utilities have been encouraging this practice.

One can, as an example, estimate total comparative hydro costs for the apartment building if individual metering was adopted under the Scenario B rate structure. First, house service consumption must be separated from total electrical consumption. Again, assume 40 percent of present energy consumption and billing demand is used for house service. The remaining KWH and KW are allocated to each rental suite**, and the hydro bills are then calculated by using the rates for the 0-50 KW customer class. To forecast the building's total hydro costs for 1978 and 1983, one must first estimate energy consumption for those years under individual metering conditions. Two different projections can be developed for comparison: (1) similar consumption patterns as 1975, or (2) a 30 percent decrease in KWH for domestic service, based on the MRI study and a HUD survey,*** coupled with a 25 percent decrease in house service consumption. Using available data and the assumptions outlined above, one obtains the figures shown in Table IV-15.

From these calculations, there are four major findings:

(1) Total electrical costs for the tenants would increase very quickly if a bulk-metered building was suddenly changed to individual metering.

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* *Under Scenario B, prohibition of master-metering would apply only to buildings which are already partly wired for individual metering. This discussion considers the impact of individual metering for this apartment building only as a hypothetical example.*

** *Assuming the 3.7 percent vacancy rate is applicable over the whole data based period (November 1974 to October 1975).*

*** *The U.S. Department of Housing and Urban Development conducted a nation-wide survey for non-electrically heated buildings. They found that individually-metered apartment buildings use an average 32.5% less KWH than comparable mastermtered dwelling units.*

TABLE IV-15. INDIVIDUALLY METERED APARTMENT BUILDING ELECTRICITY COSTS UNDER SCENARIO B

A. Constant Usage Case	KW	KWH per month	1975 Net Bill	1978 Net Bill	1983 Net Bill
House Service	157	78,047	$1,064.71	$2,350.00	$ 2,689.99
Domestic Service (per suite)	0.95	329	8.50*	13.11	20.65
Total monthly cost			4,091.00	7,018.00	11,040.00
Total cost/year/suite			135.00	232.00	372.00
Percent increase over					
i) 1975 individual metered rates				72	176
ii) 1975 bulk-metered rates				148	298

B. Conservation Case					
House Service	115	58,535	1,064.71	1,352.78	$ 2,909.94
Domestic Service (per suite)		230	8.50*	10.37	16.39
Total monthly cost			4,091.00	5,544.50	8,744.78
Total cost/year/suite			135.00	187.00	295.00
Percent increase over 1975 bulk-metered rates				100	215

Obtained by using North York's present "residential service" retail rates.

5.20 cents for the first 50 KWH
2.35 cents for the next 200 KWH
1.49 cents for any additional KWH

(2) Costs increase by only 72 percent and 176 percent in 1978 and 1983, respectively, over 1975 costs when comparisons are based on individual metering rates for all years (including 1975). Thus, such tenants are hit with a smaller increase than the system average.

(3) If the bulk-metered tenants achieve a 30 percent reduction in energy consumption through a switch to individual metering, their electrical costs would increase by 100 percent and 215 percent in 1978 and 1983, respectively, over present 1975 bulk-metered rates. Thus, for this case the increases would be greater than if the apartment remained bulk-metered, but not too different from the system's average increase.

(4) A greater portion of increased electricity costs are passed on to the tenant via the individual metering option. This may lessen the burden on the landlord, especially if rent controls are in effect.

2. Summary

Large hydro rate increases would result in higher operating costs for bulk-metered apartment buildings. The landlord(s) can make use of certain operational and technical changes to reduce energy consumption for house services, but these represent only 40 percent of total consumption. The landlord's control over domestic consumption is minimal and, unless tenants change their consumption habits, the new hydro rates will result in higher costs.

In general, higher energy costs will cause apartment owners to be much more cost conscious in energy matters, and some technical and operational innovations are to be expected. Use of simulation models and new energy sources (such as solid waste) are presently being tested out by large developers such as Cadillac-Fairview. Energy savings of 25 percent or more are forecast for house services. In fact, it was noted that anticipatory conservation measures may take place before the increases are actually implemented.

Scenario B has similar impacts as Scenario A costwise, since most building's load factors are around 50 or 60 percent. However, Scenario B might favor small and/or nonelectric

buildings less than Scenario A because their relatively low load factor would not be as large a cost factor as it is with the present D/E split.

Probably the most efficient method to modify tenant's energy consumption habits involves the prohibition of master-matering. Substantial energy savings have been reported in the United States when individual metering has been applied (Ref. IV.48). On the order of 30 percent energy reductions would probably result from individual metering, but, even so, costs would increase more rapidly than if the apartment remained master-metered. Also, individual metering would result in directly increased tenant costs, as each individual would pay his/her own bill. Under bulk-metering, higher operating costs due to increased electricity rates may or may not result in higher rental costs, depending on how much of these cost increases can be passed along to the tenants.

I. Single-Family Dwelling Case Study - A Hypothetical North York House

The 1971 Census of Canada revealed that, out of 2,225,490 dwellings in Ontario, 61 percent (or 1,365,580) were single-family detached dwelling units (Ref. IV.60). Although there has been a trend since then toward apartment living, the high number of homeowners makes the impact of electrical rate structure and rate level changes on this group of primary importance. This case study will therefore consider a representative, hypothetical house, in order to demonstrate possible impacts on homeowners.

A recent energy application survey conducted by Ontario Hydro on a number of households revealed several statistics which help to outline a "typical" household in Ontario. Some of the highlights of this 1974 Energy Application Survey (Ref. IV.61) are listed below:

(1) The saturation of electrical appliances continue to increase, often as a result of "upgrading.*
(2) Use of gas for home heating and water heating represents about one-third of the residential market.
(3) Oil was used for home heating in 47 percent of the cases (as compared to 52 percent in 1972).

**Upgrading, in the sense of more modern appliances such as no-frost refrigerators which use more energy, in general, than the older appliances.*

(4) Electric water heating saturation was 57 percent in 1974, a decrease from the 1972 figure of 59 percent.
(5) Householders living in their own homes have more modern appliances than tenants.
(6) Trends in fuel use are related to age of the home, with new homes using mainly gas for space and water heating.

In light of these facts, a "typical" house was defined as having the following characteristics:

(1) Three bedroom*;
(2) Space heating by oil;
(3) Electrical water heating; and,
(4) Meets the National Building Code (NBC) insulation standard

The house was assumed to be located in North York because of data availability. North York's 1975 electricity rates for "regular' residential customers are as follows:

Min.	¢/KWH	Blocksize	¢/KWH	Blocksize	¢/KWH(over 250 KWH)****
$4.00	5 .20	50	2.35	200	1.49

The energy requirements for this "repesentative" house are shown in Table IV-16, along with the total annual energy costs (Ref. IV.62). Its average monthly consumption of 767 KWH is very close to the average of 752 KWH/month for residential customers served by all municipalities in Ontario.

The patterns of expenditure for families of two or more persons in metro Toronto** are shown in Table IV-17 (Ref. IV.16). These figures were obtained from surveys carried out by Statistics Canada for the years 1969 and 1972. Family expenditures on electricity in Toronto as a percent of total family expenditure over the past twenty years have ranged from a minimum of 1.0 percent in 1969 to a maximum of 1.5 percent in 1959.*** (Refs. IV.63, IV.64).

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* *Average number of bedrooms per household was 2.7 in 1971 (Ref. IV.60).*

** *Include the borough of North York.*

*** *This figure includes one person families.*

**** Flat rate for water heating, $4.51/mo.

TABLE IV-16

ENERGY COSTS IN REPRESENTATIVE HOME

Location: North York
Space Heating: Oil
Water Heating: Electrical
Insulation : NBC Standard

Month	KWH	Gallons of Oil	
Jan	831	198	
Feb	796	154	
Mar	800	142	
Apr	772	95	
May	735	49	
June	726	13	
July	712	8	
August	714	6	
Sept	730	20	
Oct	763	50	
Nov	784	97	
Dec	840	174	
TOTAL*	9,203	1,007	
COSTS	$158.02	$366.55	Total - $524.57

* *Breakdown of electrical consumption-KWH/year*

Basic Use	*2249*
Cooking	*1128*
Clothes Drying	*920*
Water Heating	*4906*

TABLE IV-17

PATTERNS OF EXPENDITURE FOR TORONTO FAMILIES OF TWO OR MORE PERSONS - 1968, 1972

Family Characteristics		1972		1969
Average				
Family size		3.49		3.58
Net income before taxes		$13,780.6		$11,915.1
Other Money receipts		$251.8		$183.8
Net change in assets		$740.7		$411.0
Percentage Homeowners		59.7		62.2
Average Dollar Expenditure	**% of Total**	**Dollars**	**% of Total**	**Dollars**
Food	16.0	2,130.9	16.5	1,962.6
Shelter	16.2	2,159.2	16.0	1,903.2
(Water and fuel)*	(2.3)	(310.0)	(2.4)	(280.9)
(Electricity) *	(.93)	(123.2)	(.87)	(103.8)
Household Operation	4.0	532.3	4.4	521.6
Furnishing & Equipment	4.7	620.6	4.9	583.4
Clothing	7.2	952.9	8.1	970.2
Personal Care	1.9	248.0	2.2	259.5
Medical & Health Care	2.7	360.0	3.4	402.9
Smoking & Alcoholic Beverages	3.8	501.1	3.4	403.4
Travel & Trarsportation	12.6	1,672.2	11.1	1,319.5
Recreation	3.8	499.8	3.8	447.4
Reading	.5	68.5	.6	72.2
Education	1.1	151.4	.8	100.3
Other	1.7	229.5	1.3	155.4
Total Current Expenditure	76.2	10,126.9	76.4	9,101.8
Personal taxes	16.8	2,239.2	16.5	1,970.0
Security	4.6	610.2	4.5	531.8
Gifts & Contributions	2.4	218.9	2.6	311.0
TOTAL EXPENDITURE	100.0	13,295.7	100.0	11,914.5

* *Canadian averages for families of two or more persons.*

SOURCES: Statistics Canada, Urban Family Expenditure, 1972, Catalogue No. 62-541.

Statistics Canada, Family Expenditure in Canada, Volume III-1969, Catalogue No. 6-537.

1. Rate Scenario Impacts

a. Scenario A. For Scenario A's rate structure, the representative household's electrical costs would be as follows (assuming similar energy consumption for each year):

	1975	1978	1983
Electrical costs/year	$158.02	$300.24	$474.06
% Increase over 1975	------	90%	200%
KWH/year	9,203	9,203	9,203

In order to estimate the impact of increasing hydro rates on a family's budget, one must first attempt to forecast energy consumption. Three different estimates on projected electricity consumption have been developed based on various assumptions.

(1) A "traditional growth" forecast made simply by extending the historical trend (e.g., the least squares methods). Hence, this forecast implicitly assumes an increasing standard of living.

(2) A projection which takes into consideration existing appliance technology, which makes more efficient use of energy (assumes a 13% decrease from the traditional growth forecast by 1996)*.

(3) A "most probable" scenario where a further reduction in residential electric consumption is achieved due to voluntary conservation measures taken by the general public.

Another projection could be developed based on the assumption of fossil fuel subsitution for residential electric appliances. However, Ontario Hydro's 1974 appliance survey shows that there is a small saturation of gas use for the range, clothes dryer, and water heaters when oil is used for home heating (probably because of the high initial costs of installing distribution facilities, if available). Also, it is expected that Ontario gas and oil increases will closely parallel these electricity rate projections (Ref. IV.44). Thus, fossil fuel substitution does not seem a realistic alternative.

The percentage increases in KWH consumption for a typical house under each forecast, along with the associated

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**Based on the U.S. Department of Commerce criteria for the proposed Voluntary Appliance Energy Program.*

costs as per Scenario A, are shown on Table IV-18. The various projections result in only minor differences in electrical costs for 1978, while the 1983 figures show more variation. Based on these projections, $316 and $532 will be used as electrical costs per year in 1978 and 1983, respectively, for a "typical" household.

TABLE IV-18. HOUSEHOLD ELECTRICAL CONSUMPTION FORECASTS AND ASSOCIATED COSTS-SCENARIO A

	1975	1978	1983
"Historical Growth" forecast			
KWH/year	9,203	9,822	11,070
% increase in KWH/year over 1975	----	6.7%	20.3%
Electricity cost/year	$158.02	$320.49	$570.47
% increase in costs over 1975	----	103%	261%
"Existing Technology" forecast			
KWH/year	9,203	9,801	10,858
% increase in KWH/year over 1975	----	6.5%	18.0%
Electricity cost/year	$158.02	$319.80	$559.52
% increase in cost over 1975	----	102%	254%
"Most Probable" forecast			
KWH/year	9,203	9,700	10,332
% increase in KWH/year over 1975	----	5.4%	12.3%
Electricity cost/year	$158.02	$316.50	$532.36
% increase in cost over 1975	----	100%	237%

Implied in these forecasts are numerous second and third-order impacts of increasing hydro rates. The "existing technology" forecast assumes that manufacturers of electrical appliance will have to modify some of their designs to satisfy energy and cost conscious customers. These customers might be willing to pay more in the future for home appliances in order to save on operating costs. This could, in turn, have consequences on manufacturers' sales and profits.

The "most probable" forecast assumes a decrease in KWH consumption which can be achieved by retrofit conservation devices, addition of insulation, reduced growth rate of saturation of electricity intensive appliance, etc. The numerous impacts on the suppliers of these materials or appliances are

apparent. However, both the "existing technology" forecast and the "most probable" forecast imply rather gradual long-term impacts.

With these considerations, the estimated average income for a family living in Ontario* (Ref. IV.66),** along with the forecasted electricity expenditures are shown below for Scenario A:

TABLE IV-19. FAMILY INCOME AND ELECTRICITY COSTS - SCENARIO A

	1975	1978	1983
Average family income	$18,365	$24,684	$38,330
Electrical expenditures	$158	$316	$532
Electrical expenditure as a percentage of income	.86%	1.28%	1.39%

Thus, a larger percentage of a family's income will be spent on electricity by 1978, but this percentage will increase at a slower rate from 1978 to 1983. The extra percentage of income spent on electricity will result in reduced savings and/or changes in consumption patterns.

Personal savings in Canada are currently at extremely high levels, and at high rates relative to the past. Because of high interest rates, increasing participation rates, and increases in real wage rates, savings are expected to remain at high rates over the next two or three years. From 1978 to 1985, personal savings rates should begin to taper off slowly as participation rates and wage rates stabilize.

The above implies that increasing electrical expenditures will, in the short-term, be generally paid through a reduction in savings since they are at historically high levels. For increases in prices after 1978, it is expected that increasingly more of any higher electrical

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* *Family income was used as opposed to disposable family income because of the difficulty in forecasting the latter.*

** *This forecast was based on historic series of family income for Ontario which are published in (1) The Ontario Statistics 1975, Volume 2, Economic Series, p. 457 and 458 and (2) Income Distributions By Size in Canada, Catalogues 13-207 and 13-206.*

costs will be paid for by an alteration in the consumption pattern (Ref. IV.66). These impacts, in turn, have far reaching consequences on mortgage and other capital availability, retail sales, and interest rates.

b. Scenario B. The percentage increases in KWH consumption for a typical house under the various forecasts discussed before, along with the associated costs as per Scenario B, are shown on Table IV-20. Electricity costs do not increase quite as much under this scenario as under Scenario A. Electrical bills of $317 and $522 will be assumed for 1978 and 1983, respectively.

TABLE IV-20. HOUSEHOLD ELECTRICAL CONSUMPTION FORECASTS AND ASSOCIATED COST - SCENARIO B

	1975	1978	1983
"Historical Growth" forecast			
KWH/year	9,203	9,822	11,070
% increase in KWH/year over 1975	---	6.7%	20.3%
Electricity cost/year	$158.02	$320.07	$554.01
% increase in costs over 1975	---	103%	251%
"Existing Technology" forecast			
KWH/year	9,203	9,801	10,858
% increase in KWH/year over 1975	---	6.5%	18.0%
Electricity cost/year	$158.02	$319.49	$544.89
% increase in costs over 1975	---	102%	245%
"Most Probable" forecast			
KWH/year	9,203	9,700	10,332
% increase in KWH/year over 1975	---	5.4%	12.3%
Electricity cost/year	$158.02	$316.69	$522.28
% increase in costs over 1975	---	100%	231%
"Constant Consumption" forecast			
KWH/year	9,203	9,203	9,203
% increase in KWH/year over 1975	---	---	---
Electricity cost/year	$158.02	$302.92	$473.73
% increase in costs over 1975	---	92%	200%

With these considerations, the estimated average income for a family living in Ontario, along with the forecasted expenditure on electricity, are shown in Table IV-21.

TABLE IV-21. FAMILY INCOME AND ELECTRICITY COSTS - SCENARIO B

	1975	1978	1983
Average Family Income	$18,365	$24,684	$38,330
Electrical expenditure	$158	$317	$522
Electrical expenditure as a percentage of income	.86%	1.28%	1.36%

These figures are lower by 1983 than those found for Scenario A. The two scenarios will have similar impacts, however, and the comments of the previous section apply here as well. Scenario B's rate structure leads to lower energy consumption for households than Scenario A, though. First, special flat rates for water heating would be eliminated, and consumers would thus tend to be more conservative in their use of hot water. Secondly, the customer charge of $4.00 per month would replace the present minimum bill concept (minimum bill was $4.00 a month in North York for 1975). Since this customer charge is coupled with a KWH rate, then the consumer pays for each KWH consumed at any level of consumption. In contrast, the present (and Scenario A) minimum bill and flat water heating rate concepts may encourage waste.*

2. Impact Summary

This case briefly studies the impact of rate structure and rate level changes on a typical family living in a hypothetical detached house. First, forecasts of energy consumption which took into account traditional growth (i.e., increasing standard of living), existing technology, and conservation measures, were used in predicting KWH consumption for 1978 and 1983. Next, predictions of average family income for the next eight years were developed to determine what percentage of family income will be spent on electricity (see Tables IV-19, IV-21). From these projections it is observed that:

(a) A larger percentage of a family's income will be spent on electricity by 1978, but this percentage will increase at a slower rate from 1978 to 1983 (due to standard of living increases), and;

(b) Scenario A and B have very similar impacts except in that Scenario B might improve energy conservation by eliminating such concepts as special flat rates and a minimum billing charge.

**Note that, in practice, the minimum bill conept might encourage waste only for small consumers of electricity, while declining block or flat rates would tend to encourage waste for larger users.*

Because of the present high level of personal savings rate in Ontario, short-term electricity rate increases (i.e. up to 1978) result in lower savings rates. Further rate increases are expected to be met through cutbacks in other expenditures. Finally, rate increases for households will certainly result in numerous impacts on suppliers of electrical appliances, on contractors, etc. However, present forecasts imply rather gradual, long-term impacts.

J. Municipal Utility Case Study: Hydro Mississauga

Currently some 353 municipal utility companies buy wholesale power from Ontario Hydro. These municipal utilities, in turn, sell power at retail rates to residential, commercial, and industrial customers. Municipal utilities perform most maintenance and customer service activities in Ontario's power system. They therefore deal more directly with end use customers (and their problems) than Ontario Hydro itself.

Retail electricity rates are now set individually by each municipal utility, though final approval for all proposed new rates must be obtained from Ontario Hydro. Variations in retail rates exist among the municipalities. These variations are largely due to the tremendous differences which exist in the size, growth rate, mix of customer classes, and customer density among the areas served by the municipal utilities. Also, variations in the total cost of primary power have resulted from differences in the uncommon costs allocated to various municipal utilities and from varying levels of Ontario Hydro equity (along with credits for return on equity) held by these utilities.* Retail rates also vary because of the differing methods by which municipal utilities allocate costs and customers to the various customer classes, as well as because of the differing ways in which capital expenditures are financed. However, local utilities do not have the right to intentionally subsidize one class of users at the expense of other classes, and are thus somewhat restricted in their rate setting flexibility.

Municipal utilities are represented in political matters by the Ontario Municipal Electrical Association. Technical assistance is provided to municipal utilities by the Association of Municipal Electric Utilities.**

This concept of return on equity will be phased out ast of 1977.

***See Chapter III for discussion of the reaction of these two groups to the rate change scenarios.*

Hydro Mississauga is a large growing municipal utility servicing a variety of customers, which numbered 52,100 in 1974. It is close to Provincial averages in total revenues per KWH in each of four statistical categories: (1) all users, (2) residential, (3) general less than 5000 KW, and (4) over 5000 KW. It's total costs for primary power per KW and KWH are also fairly close to the average for municipal utilities. Some general statistics for Hydro Mississauga are shown on Table IV-22. One observes from the table that Mississauga's distribution of sales, revenues, and customers are fairly close to the average for all municipalities.

Hydro Mississauga is one of the 15 utilities which was using traditional (or Wright) rates as of July 1, 1975.* Hence, different rates were charged to its three classes of non-residential customers: small commercial, commercial, and industrial. As for its residential rates, it presently makes use of special rates for metered water-heating customers only (for a block of 500 KWH per month).

Because of its location immediately southwest of metropolitan Toronto, Mississauga has experienced rapid growth during recent years. Its net fixed assets grew from $28,825,773 in 1970 to $39,398,482 in 1974, or by 37 percent. Total KWH sales increased at an average annual rate of 12 percent over this period. Net income, together with depreciation charged, contributed capital, new borrowings, and an increase in other liabilities provided for this increase in assets. Mississauga relies heavily on long-term debt; its debt-equity ratio was 33:67 in 1974, as compared to the overall ratio of 14:86 for all utilities.** It also relies heavily on contributed capital which made up close to 50 percent of its equity base in 1974. This contributed capital is supplied by residential subdivision developers to cover the entire cost of the required "internal" distribution facilities.

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* *Note that even though only 15 utilities use the traditional rate structure, they service over 50% of the Ontario population. However, Mississauga's rates were recently modified so that commercial and industrial rates were equalized. This is seen as an initial step towards a switch from the traditional to the general rate structure.*

** *Including contributed capital as part of equity. In comparing Mississauga's debt/equity rate to the average for all municipal utilities, one must take into consideration Mississauga's faster than average growth rate.*

TABLE IV-22. Comparative Statistics for Hydro Mississauga - 1974

	Hydro Mississauga	Percent Breakdown	Total for All Ontario Municipal Utilities	Percent Breakdown
Total Sales - Thousand (KWH)	1,999,642	100	550,237,589	100
- residential service	477,223	24	14,811,689	29
- general (under 5,000 KW)	1,096,721	55	26,553,483	53
- general (over 5,000 KW)	409,328	20	8,343,999	17
- street lighting	16,370	01	528,418	01
Total Revenue - (Thousand Dollars)	27,263	100	711,420	100
- residential service	7,684	28	241,838	88
- general (under 5,000 KW)	15,044	55	375,188	53
- general (over 5,000 KW)	4,313	16	87,018	12
- street lighting	221	01	7,377	01
Total Customers	52,110	100	1,872,461	
- residential	46,844	90	1,654,065	88
- general (under 5,000 KW)	5,261	10	218,295	12
- general (over 5,000 KW)	5		101	
Revenue - (Cents/KWH)	1.36		1.42	
- residential	1.61		1.63	
- general (under 5,000 KW)	1.37		1.41	
- general (over 5,000 KW)	1.05		1.04	
Avg. Monthly Peak Load - (KW)	313,120			
Avg. Monthly Energy Purchased (Thousand KWH)	171,942			
Avg. Monthly Load Factor	75%			
Total Charge for Primary Power				
$ per KW	70.11		66.84	
Mills per KWH	10.64		10.62	

Source: Ontario Hydro Statistical Yearbook, 1974.

A breakdown of Hydro Mississauga's expense is shown below:

Expenses (1974)		
Power purchased	$22,082,604	81.8%
Operation and Maintenance	1,098,662	4.0%
Administration	1,101,138	4.1%
Financial	1,730,929	6.4%
Depreciation	1,007,998	3.7%
Total Expenses	$27,021,331	100.0%

Thus, bulk power costs represented 81.8 percent of total expenses in 1974. One also notices that even though Hydro Mississauga makes relatively extensive use of contributed capital, its financial charges represent over 6 percent of total expenses (Ref. IV-67).

Hydro Mississauga was represented in the case study by the following: Mr. Bert Fleming, General Manager and Secretary; Mr. Minoo Treasurywala, Treasurer; and Mr. Ken Posgate, Director of Consumer Affairs.

1. Scenario A

Doubling the bulk power rates by 1978 would, of course, severely affect Hydro Mississauga's total expenses. Bulk power costs are estimated to make up 86 percent of 1976 total expenses. Since controllable costs would become a smaller portion of total expenses in 1978, Mississauga Hydro would have even less control over rates paid by its customers.

As electrical rates rise sharply, local pressures to cut total expenses would undoubtedly become great. Present rate structures do not isolate bulk power costs from the utility's controllable costs, with the result that the municipal utility often becomes the focus of criticism. Hydro Mississauga controls Operation and Maintenance, Administration, and Finanical costs, and these would be the three areas where expenses would be reduced. Based on the 1976 budget (in which cost of power represents 86 percent of total expenses), it is estimated that retail rates may be reduced by 0.1 percent O.M. & A. costs are reduced by $24,000, or if capital expenditures are reduced by $171,428 (Ref. IV-68).

Some of the cost cutting measures considered by Hydro Mississauga are listed below:

(a) Postpone system backup capital outlays as a calculated risk in reducing financing charges. This step is already being implemented with the result that 1976 issued debentures are expected to be reduced from the projected $1.5 million to $1 million.

(b) Eliminate the rental and installation of hot water tanks. An estimated $220,000 will be tied up in rentals in 1976. Eliminating this service could again reduce financing charges. However, the decision to get out of the water heater rental business is being delayed by Hydro Mississauga until more information is known about the impact of such a decision on retail customers.

(c) To reduce operations and maintenance costs, Hydro Mississauga could delay equipment replacements and minimize overtime work. Overtime maintenance work would be carried out only for emergencies. To reduce the occurrence of emergency situations, Mississauga presently makes use of a program of planned maintenance which would not be phased out as rates increase. It was also pointed out that, because of this utility's recent rapid growth, it does not face as major reconstruction costs as other utilities with older distribution systems (e.g. Hamilton and Toronto).

(d) To control administration costs, several steps could be taken:

(1) Reduce customer service telephone inquiry responsiveness. This step might result in a reduction of the public's respect and credibility vis-a-vis the municipal utility.

(2) Freeze salaries (salaries of the top seven executives are frozen for 1976).

(3) Make use of longer meter-reading schedules (this step is already in the implementation stage, with the goal being a yearly meter-reading schedule). The impact of this measure on customers' consumption patterns is uncertain, due to lack of past experience. That is, longer feedback periods might reduce the consumer's sensitivity (i.e. conservation response) to certain price signals.

Postponement of system backup capital outlays and reductions in overtime maintenance work might well result in more frequent and longer power interruptions. This, in turn, could result (in the short run) in increasing customer complaints. Requests for meter checks and explanation of bills might very well increase as rates continue to increase rapidly. Mississauga might even face the new problem of meter tampering which has made its appearance in some American cities in the last couple of years. Finally, Scenario A's rates might result in increasing bad debts. However, Mississauga presently requires a deposit from tenants, which results in bad debts representing a small percentage of total revenues (0.06 percent of total revenues for this utility in 1973).

Scenario A would cause Mississauga's controllable costs to become an even smaller percentage of total costs. In order for the utility to cope with the problem vis-a-vis its customers, it could make use of such alternatives as (1) public information campaigns designed to explain the reasons for rising bulk power costs and the large portion of total expenses which it represents, or; (2) use a separate billing component isolating the municipal utility's costs (towards which the "customer charge" of Scenario B is a significant step).

The major impact of Scenario A type rates for a fast growing municipality such as Mississauga would be on capital availability and cost. Mississauga's present debt to equity ratio of 33/67 is higher than average for municipal utilities, but is reasonable for a fast growing utility. This ratio might very well increase in the future (especially if bulk power rates increase drastically, causing net income to decrease) and the result would be higher debenturing costs. The amount of future debt also depends on the mixture of customers which make up Mississauga's retail system. As previously mentioned, a contributed capital on all new residential subdivisions is used to finance all internal distribution costs.* Thus, an increasing concentration of industries in the area, for example, would probably result in a higher debt-equity ratio. The prospect of such a possibility makes it more imperative than ever for Mississauga to control costs and capital expenditures.

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* *Note that this system has been in use since 1952 and is imposed to finance "internal" distribution costs within the subdivision. The result is lower than average residential rates, since distribution costs have already been partly paid. This levy is considered by D. White (from the AMEU) to be "internally" equitable, but different from the procedure used by most municipal utilities.*

2. Scenario B

Scenario B includes the bulk rate doubling discussed before, but has several additional features of importance to Hydro Mississauga. Scenario B imposes Province-wide uniform KW and KWH rates. Mississauga officials are not opposed to this rate structure concept if: (1) the new rates provide a better pricing signal to retail customers, and; (2) the new rate structure provides the utility with the ability to modify certain portions of the rates to reflect Mississauga's expenses. In fact, Mr. Fleming approves of the concept of pooling non-controllable costs.

Scenario B rates, as they were developed for this report, include most of the municipal utility's costs in the customer charge. Such items as conductors and meters were included in the customer charge and resulted in the large differences in customer charge from one customer class to the next. Mississauga officials believe that there should be some further differentiation within at least 50-3000 KW category for equitable assessment of the monthly customer charge.

Mr. Fleming was more receptive to the recent NERA proposal which would shift a number of items from the customer charge to the demand charge. For example, the smallest meter size (and cost) varies with the number of customers and is customer-related, whereas the balance is demand-related. Under this scheme, the municipal utility's costs would be embedded in both customer and demand charges. Preference was given to this alternative because: (1) it is more equitable (customer charge would not differ as much between various customer classes), and; (2) the utility can show it effectiveness by varying both customer and demand charges.

Table IV-23 demonstrates how much Hydro Mississauga's revenues would increase by 1978 if Scenario B rates were applied to its customers. As a detailed breakdown of customers was not readily available, one cannot obtain total revenue for Mississauga, but this table does provide some insights.

(a) Revenues from the residential sector would not double by 1978. Also, low use customers (such as individually-metered apartment dwellers) could face increases as low as 50 percent.*

**In calculating monthly 1975 bills for medium and High use customers, Mississauga's special metered water heater rate was applied. Under Scenario B, this special rate would be eliminated.*

TABLE IV-23. PERCENTAGE INCREASES IN HYDRO MISSISSAUGA'S BILLING CHARGES-SCENARIO B 1978

Sector	Monthly Consumption (KW)	Monthly Consumption (KWH)	Monthly Charges-1975 (Dollars)	Monthly Charges-1978 (Dollars)	1975 to 1978 Increase (Percent)
Residential	-	250	$ 7.33	$ 10.93	49%
	-	500	10.33	17.85	73
	-	750	13.33	24.78	86
	-	1,000	16.83	31.70	88
	-	1,666	26.32	50.17	91
	-	2,500	37.91	73.25	93
	-	3,333	49.50	96.33	95
Commercial and Industrial Less Than 3000 KW	10	2,000	44.20	59.40	34
		2,993	51.15	86.91	70
		4,964	64.95	141.50	118
	50	10,000	221.00	752.50	240
		15,000	256.00	842.50	229
		24,820	324.74	1,020.24	214
	100	20,000	442.00	1,104.00	150
		30,000	512.00	1,285.00	151
		49,640	649.48	1,640.48	153
	600	98,550	2,210.00	3,893.75	76
		150,000	2,560.00	4,825.00	88
		250,000	3,260.00	6,635.00	103
	1,000	197,100	4,420.00	7,387.51	67
		300,000	5,120.00	9,250.00	80
		500,000	6,520.00	12,870.00	97
	2,000	394,200	8,778.20	14,375.00	64
		598,600	10,232.20	18,074.06	77
		992,800	12,991.60	25,209.68	94
Industrial over 3000 KW*	75,000	450,000,000	5.5 Million	11.8 Million	115

Data given is a total for the 10 industries in Mississauga. These industries represent 21 percent of Mississauga's total electricity consumption.

Source: Monthly Rates and Comparative Bills, Ontario Hydro, 1975.

(b) Commercial and industrial customers under 3000 KW would face varying percentage increases in their electrical bills, depending on their KW consumption and load factor.

(c) The customers using 50 to 150 KW would face the highest increases (up to 240%). Over 30% of Mississauga's industrial and commercial customers under 3000 KW fall in the 50-150 KW category.**

(d) The percentage increase in electrical bill also becomes larger as the customer's load factor increases (within the same KW demand). This is especially true for those customers using less than 50 KW.

Two of the Scenario B's sensitivity concepts, peak/off-peak rates for large users and the new interruptible service format, do not cause great concern to Hydro Mississauga. First, Mr. Posgate estimated that the required new metering equipment for the ten large users to be affected by peak/off-peak rates would be feasible at a relatively small cost. Secondly, presuming that Hydro Mississauga's chief role in administering interruptible service contracts would be to inform customers of interruptions by telephone, Mr. Fleming foresaw no problems, saying that municipal utilities have performed similarly in emergency situations as a matter of course (Ref. IV-69). These two concepts would be of major significance to Mississauga, as over 20 percent of its power is sold to large users (over 3000 KW).

Mr. Posgate pointed out that changing the standard twenty minute average demand measurement may require regulatory change by the Federal Department of Weights and Measures (Ref. IV-69). After further technical consultation, Mr. Posgate stated that "rebuilding Mississauga's approximately 4000 demand meters in service to a one-hour measurement, could not be practically done in the field. Rather than rebuild meters in the shop, we would buy new ones." Estimated costs for this change are

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** *The customers in this category include:*

- *Manufacturing and processing industries*
- *Bulk-metered apartment buildings (40 to 100 suites)*
- *Office buildings (10,000 - 20,000 square feet)*
- *Retail Stores (7,000 - 15,000 square feet).*

The approximate customer breakdown in this category, by demand characteristics, is as follows:

- *61 percent 0 to 10 KW demand*
- *14 percent 10 to 50 KW demand*
- *18 percent 50 to 100 KW demand*
- *7 percent 600 KW demand and above*

approximately $150 per meter plus $50 for labor. Therefore, the metering change could cost Hydro Mississauga $800,000 for all its 4000 demand meters. To reduce this cost by phasing in the new meters with the existing schedule of routine meter checks would prove too slow, according to Mr. Posgate. Commercial and industrial meters are presently tested and calibrated at intervals of six years.

Prohibition of bulk (or master) metering of new multi-family dwellings would present significant costs to Hydro Mississauga. For example, a 1963 AMEU paper reported that total meter and billing costs was $1.00 per meter per bill. (This cost includes meter amortization and depreciation, meter reading, billing, and collection.) More recent data on total metering costs is not yet available, and Mississauga is thus favourable to maintaining bulk-metering until a cost/benefit analysis is performed and proves the advantages of individual metering. Finally, public response may be adverse to the apparent reversal of a recent policy of municipal utilities to strongly encourage bulk metering.

3. Summary

Major rate level increases such as those of Scenario A would have important consequences on a fast growing municipal utility such as Hydro Mississauga. The main impact would be on capital availability and cost. To cope with the impact, Hydro Mississauga will attempt to control or reduce O.M. & A. costs and delay capital expenditures. These steps might result in more frequent and longer power interruptions in the municipality. On the other hand, Scenario A would cause Mississauga's controllable costs to become an ever smaller percentage of total expenses (estimated 86 percent for 1976).

Scenario B rates are welcomed by Hydro Mississauga officials if: (1) the new rates provide better pricing signals to customers, and; (2) the new structure provides some rate setting flexibility for the utility to reflect its effectiveness in controlling costs. Revenues to Mississauga, as per Scenario B, would increase drastically from some customer classes and moderately from others. Residential revenues would less than double by 1978, while commercial customers using 50 to 100 KW would face increases from 150 percent to 300 percent in their bills by 1978.

Over 20 percent of Hydro Mississauga's sales are for customers in the over 3,000 KW class. This portion could be subject to peak/off-peak rates, and could be sold as interruptible power. No major problems were foreseen in the implementation of these concepts. As for prohibition of bulk-metering, Hydro Mississauga is in favor of maintaining bulk metering until cost benefit studies prove the superior advantages of individual metering.

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V. POSITION STUDY OF PARTIES AT INTEREST

Any major modification to the existing rates governing the sale of electricity throughout Ontario may be expected to encounter both support and opposition among the various parties at interest.* In reference to this study, the interested parties include those organizations which have publicly articulated viewpoints on the appropriate structure for electricity. rates and/or the growth of the electric power industry in Ontario, in addition to organizations which are otherwise likely to be concerned with modifications of existing provincial rate structures. The purpose of this chapter is twofold:

- To examine the rôle of each interested party as a public participant in the setting of wholesale (or bulk) and retail electric power rates;
- To analyze the viewpoints of each interested party concerning the nature of impacts associated with variations on the existing power rate level and structure.

To accomplish these tasks, the major parties at interest were identified and representatives from each were interviewed at length. Each representative was provided with a description of the two scenarios as well as the concepts for sensitivity study on the second scenario. The representative was then asked to respond according to his organization's philosophy and objectives, to determine the relative disposition of his group to the salient features of each scenario. The scenarios were presented in the following manner (see Chapter III for further detail):

- Scenario A - Approximate doubling of bulk power rates between 1975 and 1978; no structural change in rate pricing
- Scenario B - Approximate doubling of bulk power rates by 1978. Change in rate structure as follows:
    - Basic Scenario B - structural change to provide new demand/energy split of 35/65; uniform provincial demand and energy changes

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**Generally, this refers to groups of citizens (in a private or quasi-public capacity) which organize for the express purpose of influencing public policy with specific goals or objectives to be achieved.*

for three new customer classes; a customer charge imposed on all end users of electric power, derived from: (1) at the wholesale level, the "avoidable" costs which Ontario Hydro would avoid by not providing electri city service to a given municipality; and (2) at the retail level, the "fixed" costs of each municipal utility which do not vary directly with the demand or energy require ments within that municipality.

- Sensitivity Concepts for Scenario B - In addition to the Basic Scenario B, four concepts were examined individually to consider their potential contributions in making Scenario B desirable to the various interested parties. These concepts are:

a. Peak/off-peak rates for large users
   (1) non-coincident peak demand period measured between 700 and 2300 hours

   (2) .15¢/KWH peak/off-peak differential

b. Change peak demand measurements from 20 minutes to one hour

c. Prohibit master metering in multifamily dwellings

d. Interruptible service based upon tendered bid and probability of interruption.

As a position study, this chapter attempts to identify and compare the values, perceptions, and goals of each major party of interest. Taken as a whole, this should provide a useful analysis of those factors which comprise the policital/institutional climate affecting the future of electricity sales in Ontario. Specifically, insight is provided here in three significant areas:

- The identification of supporters and opponents of specific measures in the above scenarios affecting electricity rates

- The probable extent of the institutional community's involvement in rate-making

- The political feasibility of altering the rate structure status quo

In examining these topics, this chapter establishes the framework for more detailed analysis of the impacts of new rate structures on individual power consumers. The position study's role in this regard is important for the following reasons:

- Virtually all end-users of electricity in the Province are represented, directly or indirectly, by the groups under study in this chapter. (Unorganized social groups such as the poor and elderly are perhaps the least explicitly represented by existing groups.)

- The association of certain viewpoints with specific interest groups underscores the social and economic tradeoffs affecting each consuming sector under a given scenario.

- The expectation of impacts as perceived by the major interest groups (representing most ultimate power consumers) is of importance comparable to any projection of those impacts. Public acceptance of new policies is significant in the implementation of such policies.

- Soliciting the views of the various affected publics prior to instituting a major policy initiative is consistent with the spirit of public participation as well as effective in precluding dissent based on mistrust or misunderstanding.

This section is significant in describing the political/institutional climate within which bulk power rates are determined in Ontario. It is complementary to the case study approach in identifying the potential impacts of rate changes by establishing a baseline of current public opinions and objectives. Most importantly, it places in perspective the intended results of any major rate change with these impacts narrowly perceived and of central concern to the individual interest groups.

Analyses of the viewpoints of each interest group are provided in following sections. A brief discussion concerning the policy implications and the political feasibility of each scenario component is presented at the conclusion of this chapter.

A. The Interested Parties and Their Individual Views

The general background, involvement in rate-making, and considered opinions on the rate scenarios of each party at interest are presented in the following. It should be noted that the interviews upon which these discussions are based were informal and preliminary, and that the views expressed by various individuals must be considered as only their own. As a result, the views expressed are not necessarily the positions which would be taken at future Ontario Energy Board hearings on such rate proposals.

1. Association of Major Power Consumers of Ontario

The Association of Major Power Consumers of Ontario (AMPCO) since late 1974 has become the voice of the large industrial community in dealing with the electric power industry and Ontario Hydro in particular. Prior to that time, the major industrial association in this area was the Association of Direct Customers of Ontario Hydro (ADCOH). Since this change, AMPCO has come to represent several of the large industrial customers of municipal utilities. Thus, AMPCO embodies a commonality of interests among all heavy industries wishing to belong for the purpose of ensuring equitable electricity rates and service.

AMPCO's primary objectives, have essentially remained constant throughout the reorganization. These objectives are as follows: (Reference V.1).

- Maintain pressure on Ontario Hydro, the Ministry of Energy and the Ontario Energy Board to:

  (1) hold down total costs
  (2) provide a more equitable energy charge
  (3) provide a more equitable demand charge
  (4) allocate total costs to the ultimate end-customer, regardless of whether served by Hydro or the municipal electric utilities.

- Continue to strongly resist Hydro's recovery of alleged deficits.

a. Involvement in Rate-Making. AMPCO, and its predecessor ADCOH, have provided testimony before the Ontario Energy Board in both 1974 and 1975 (Refs. V.2 and V.3). Among the major criticisms voiced include inadequate incentives for peak load management; developing expension plans without adequately considering what customers can reasonably

afford to pay; and an insufficient recognition of demand costs as separated from energy costs in wholesale pricing. These and other areas of concern are elaborated upon in the discussion of the scenarios which follows.

Indications of AMPCO's expected position on these rate scenarios were provided in separate discussions with Mr. Edward Bielawski, AMPCO's representative to the Hydro Liaison subcommittee (Ref. V.4), and Mr. Keith Kidd, legal consultant to AMPCO (Ref. V.5).

b. Position on Scenario A. With respect to the revenue doubling requirement by 1978, both Mr. Bielawski and Mr. Kidd were opposed, believing that a rate increase of that magnitude is excessive. Mr. Kidd asserted that "the economic circumstances today are different!....since we have moved out of the era of low cost hydro power." He recognized the fact that "substantial new costs are necessary," due to rising labor, fuel prices, etc. But, he added, that "it is in everybody's interest to learn to limit that growth." He suggested that growth projections could be limited by taking a more "aggressive stance on conservation," since consumers "can live within lower reserve margins."

With respect to maintaining the existing rate structure, AMPCO is ambivalent; although specific changes in the rate structure are desired, AMPCO would prefer to assess any proposed new structure before stating its choice.

c. Position on Scenario B

(1) Basic Scenario B. AMPCO accepts in principle the concept of having uniform demand and energy rates, "as long as they are cost justified," according to Mr. Kidd. He acknowledged their opposition to "rates based on old versus new customers," and said that they were pleased that the "crazy equity system (giving older customers a rate benefit) is gradually disappearing."

AMPCO's strongest opposition is toward the proposed shifts in the demand/energy revenue split to 35/65. Mr. Kidd claimed that "although they are not happy with the way it is (they are no happier with) the way its projected," he explained that the problem was in properly allocating costs other than those which are fixed (demand) and those which are fuel related (energy). The other costs are usually in the area of operation and maintenance, and he feels that too many are improperly attributed to energy costs. Given that the system is going largely nuclear which is capital intensive, AMPCO considers a re-evaluation of this proposed ratio necessary. Mr. Kidd added that the U.S. Federal Power

Commission (FPC) has established guidelines for costs allocation, as has the National Association of Regulatory Utility Commissioners (NARUC) in its Cost Allocation Manual. He would prefer to see either of these sets of guidelines used over the criteria employed by Hydro in cost allocation, believing that a 35/65 D/E split would not be justified under the criteria employed by FPC and NARUC.

Mr. Bielawski also feels that such a proposed split would send the wrong signals to consumers in terms of providing incentives for consumers to act in the most efficient manner so as to reduce Hydro's costs as incurred. Therefore, he considers the proposed split with its de-emphasis on demand and load management as "the wrong way to go."

In relation to the discretionary customer charge as administered by the municipal utilities, AMPCO is ancertain on its position and wants to study the concept in more detail before responding.

(2) Sensitivity Concepts for Scenario B. Referring to the provision of peak/off-peak rates for large users, Mr. Kidd claimed that AMPCO is "very much in favor of that type of concept." He is "satisfied that economy can be achieved by at least some industries," using a non coincident peak demand measurement. He felt that this measure "can be quite effective in trimming the growth in demand." However, he cautioned that "trimming energy costs involves value judgements as to what [consumption] is necessary. Energy is more elusive [to influence than demand] since production varies." Nevertheless the rationale of an energy price differential appealed to him, and he said that this would be "a proper signal to put out to users."

Mr. Bielawski was somewhat less enthusiastic about this provision. He said that a .15¢/kwh differential is "not sufficient" for a plant to convert operations to benefit from it. The percentage reduction in energy costs for most industries would be "so slight" that this measure would "not [provide] enough incentive."

Regarding the proposed change in peak demand measurement, both men were favorably disposed. Mr. Bielawski felt this would be "beneficial to industries... [by affording them] more time to correct errors "in not preventing needle-peaks. Mr. Kidd thought that this was a bright concept and would be "much more manageable" from the users point of view.

With respect to a prohibition of master metering in multifamily dwellings, although such a provision has no direct bearing on AMPCO, both men approved of it in principle and as consumers.

Finally, an ambivalent reaction was elicited in response to the interruptible service option based on tendered bid and probability. Mr. Kidd said that "from a functional point of view, there aren't that many users" able to take full advantage of it. "Most [industries] aren't that sophisticated to get into any kind of bidding process." He thinks that the "total [capacity saved by] interruptible sales at present is relatively small next to [Hydro's] reserves." More interruptible service than is presently marketed can be sold, but the primary reasons that it is not is: (1) ignorance of its potential usefulness, and (2) lack of a major selling effort by Hydro and AMPCO. At present, however, he feels that the market is too small to expect much of a response from this measure. Unless the market proves to be more substantial, "auctioning" a greater proportion of reserve capacity may be ineffective.

d. Future Activities and Areas of Concern. AMPCO may be expected to continue serving as an intervenor in future rate hearings, as its members expect to be heavily impacted by a rate increase or a change in the wholesale rate structure. Of primary concern will be any major shift by Hydro in establishing a new D/E split which puts the major revenue burden on energy costs. Other areas of concern to AMPCO are the incentives provided to industry to save electricity costs through load management and the purchase of interruptible service. More formal positions on the above scenario components may be taken in the near future, following a thorough review of all potential ramifications by AMPCO personnel.

2. Association of Municipal Electric Utilities

The Association of Municipal Electric Utilities (AMEU) is the technical or staff arm of the municipal electric utilities of Ontario. Prior to 1918, it was known as the Engineering Section first of the Niagara Power Union and then of the Ontario Municipal Electric Association. Afterwards, it became independent, and assumed its present title in 1919. It's purposes since that time have been essentially twofold:

- To further the interests of the municipal utilities, and to foster cooperation among the muncipalities distributing electrical energy, Ontario Hydro, and the Ontario Municipal Electric Association.

- To provide an organization for the mutual assistance of its members, particularly education in technical, accounting, and commercial matters

a. Involvement in Rate-Making. AMEU's role in protecting utilities is basically one of "behind the scenes efforts," in conducting its own studies as well as contracting for consultant services. Perhaps foremost, AMEU provides OMEA with the technical information required to present the utilities viewpoints to government as well as to the public. Traditionally, AMEU defers testimonial intervention to OMEA as the public voice of the municipal utilities.

AMEU was represented by Mr. Donald White, Chairman of the AMEU Rates Committee, and Mr. Emmett Campbell, Chairman of the AMEU Impact Group and representative to Ontario Hydro's Power, Costing, and Pricing study (Ref. V.6).

b. Position on Scenario A. The initial reaction to Scenario A was that of questioning the purpose or considering a change in the existing structure. Mr. White said that "any rate scheme can recover costs." Although he recognized that some problems exist with the current rate structure, he preferred to withhold comments until the alternative structure of Scenario B was presented.

As far as the magnitude of rate increase is concerned, Mr. White stressed and Mr. Campbell agreed that most municipal utilities are faced with "higher requirements for maintenance now than ever before." He added that the system has grown markedly since World War II, with many of the older facilities due for repair and replacement expenditures within the next few years. Mr. White's fear is that if an inadequate rate increase results from political pressure, the operating costs of most utilities will be cut too far. Since "85% of operating costs [are required for] buying electricity," this means that the quality of service will probably suffer. Thus, utilities will be "hit with the need to contain costs [just at the time when] such costs would balloon."

Mr. White asserted that one result of this cost squeeze may be putting utilities "out of the water heater rental business." For example North York Hydro now rents about 50,000 units. If it discontinued service, replacement costs to its customers on the order of $.5 million might result in the next few years, since municipal utilities are precluded from performing installation work.

Other revenue losses to the utilities may occur from inadequate maintenance as a result of lost sales during time when poles or lines are down. Mr. White claimed that

utilities "simply cannot justify having more sophisticated equipment (to prevent or shorten the length of outages) on the basis of lost sales." The utilities have been "trying to put a value on undelivered energy" from such lost sales, but they have not been entirely successful in doing so. Thus, AMEU favors the revenue doubling provision as probably necessary to provide for adequate maintenance and service as well as new capacity; however, AMEU remains apprehensive about the political climate affecting the size of the increase and assumes that the actual increase will end up lower than that which either Hydro or the Energy Board have recently recommended for 1976.

c. Position on Scenario B

(1) Basic Scenario B. Mr. Campbell stated that he thinks Scenario B is a "step in the right direction." He favors having a new demand/energy split, and added that a "fixed energy rate [province-wide) seems to have a lot of acceptance." Mr. White also felt that a new D/E split was in order, but he expressed "some reservation about [going] all the way to 35/65." Commenting on the notion of a discretionary customer charge, Mr. White claimed that he had "no objection to the philosophy [behind it]," but added that some scaling of charges in the 50-3,000 KW customer class may be desirable, depending on the demand spread among the middle-sized consumers in a given municipality. Also, if Scenario B is based on LRIC principles, this would make him somewhat skeptical over the accuracy of these estimates, as he felt LRIC does not fully account for factors such as continuing price controls and other government regulations affecting utility costs.

A major area of concern to AMEU is how the customer charge itself is derived by Ontario Hydro and how it is then assessed to the municipal utilities. For example, the question arose that since some municipal utilities own transformer facilities, how would their customer charge as assessed by Ontario Hydro differ from utilities lacking their own such facilities? It was explained that these differences would appear in the customer charge Ontario Hydro imposes on each municipality, based on the avoidable costs associated with providing service to each particular municipality. Both Mr. White and Mr. Campbell requested further clarification regarding which costs would then be considered fixed, and on what basis these might be apportioned among the customer charges imposed on municipal utilities.

Mr. White envisioned one interesting complication which municipalities may have in passing through the customer charge to their own direct customers. Some muncipalities such as Mississauga have for many years recouped their local distribution cost through an indirect taxation procedure. The municipal government has long imposed a "mortgage surcharge" for providing electrical service to new customers, which amounts to a "capital contribution...from the builder." Although he was not certain of the precise mechanism employed, Mr. White intimated that this surcharge is eventually funded through to Mississauga Hydro. If variations in the local distribution costs are to be reflected in the customer charge imposed by municipal utilities, other municipalities might be inclined to use this type of mechanism to reduce their own local distribution costs. Mr. White indicated that if other utilities start using this procedure now, they in effect would be "discriminating against the new guy." Thus, the customer charge could be circumvented as a means of recovering capital costs of new transmission facilities, at the expense of new developers.

Notwithstanding the various uncertainties and some possible complications arising from Scenario B, Mr. White and Mr. Campbell both preferred the basic philosophy of this scenario over the present rate structure.

(2) Sensitivity Concepts for Scenario B. Mr. White is entirely in favor of load improvement through peak/off-peak demand and energy rates, "if it can be accomplished." He has frank reservations on the extent of the potential market for off-peak power. For example, he asserted that "very few industries [would be] looking in terms of night shifts." However, he envisaged a growing demand by individual customers for peak/off-peak rates, and the utilities would "have to devise a way to give that to the apartment dweller as well as the individual homeower."

Both Mr. White and Mr. Campbell were ambivalent over a hypothetical prohibition on bulk metering in multifamily dwellings. Mr. White felt it would be too inflexible to say, "we can't live with an abolition of bulk meters." However, both men cautioned that this would be an extremely difficult and expensive policy to implement. Mr. Campbell cited the potential impact of bad debt write-offs, which presently amounts to one-tenth of one percent of North York Hydro's annual revenues. He then predicted an increase in defaults this year, in any event, of between 25-40 percent over

those of the previous year, based on key economic indicators. When asked about the deterrent affect of having a deposit system for tenants, he replied that utilities will "never [be able to] go back to a deposit system in the residental sector, unless it is legislated." Mr. Campbellthen added that it was even uncertain whether electric bills are actually any higher when bulk metered, rather than an equal number of individual bills. This, he said, "depends on how much the developer marks up his electric bill" for the individual units. The mark-up itself depends on external financial arrangements such as the mortgage surcharge [discussed earlier], thus complicating any comparison of bills metered individually or in bulk. Therefore, Mr. White said "the only legitimate comparison [of bills] is where the units have been changed [from individual] to bulk metering."

In proposing a change in the peak demand measurement, the engineering rationale (relating load duration to capacity required) was explained in terms of more accurately reflecting costs as incurred. Mr. White said he suspects that that is "a valid assumption."

Finally, both Mr. Campbell and Mr. White approved of the interruptible service option in principle, but they wanted to know more specifics about its manner of implementation before giving more detailed critiques.

d. Areas of Concern and Future Activities. The AMEU is most interested in learning more of the details underlying the rate scenarios. Specific clarifications are sought in relation to exact determination of the customer charge and the scope of options in providing interruptible service upon tendered bid. Greatest concern has been expressed over the hypothetical banning of bulk meters, indicating a need for further study to determine the best manner, if any, in which this may be achieved.

AMEU plans to continue providing its technical support services for OMEA, and has no intention of becoming an intervenor in future rate hearings.

3. The Ontario Provincial Association of the Consumers' Association of Canada

The Ontario chapter of CAC was founded concurrently with the national CAC 28 years ago, with the central purpose

of providing an informed voice in consumer affairs. With a provincial membership of 35,000 and between 20-30 local CAC's, consumers' views are presented to local and provincial agencies as well as to the Federal government. As an incorporated, non-profit, non-sectarian organization, its primary concerns include: consumer education; improving public health and safety standards; environmental protection; and related areas where governmental policies affect the social and economic well-being of the consumer.

. a. Involvement in Rate-Making. CAC (Ontario) has been very active as an intervenor in hearings before the Ontario Energy Board, both in 1974 and 1975. In previous testimony (Ref. V.7), the CAC has questioned numerous aspects of Hydro's operations, including: the size of the rate increase requested; the value of maintaining the present debt-equity ratio; the necessity of including even 50% of the System Expansion Charge in its rate base; the allegedly small emphasis placed on conservation policies in load forecasting; and several other areas. A primary objective of CAC's involvement in rate-making is to minimize consumer hardships associated with dramatic rate increases, which may be partly a result of an allegedly aggressive expansion program on the part of Hydro.

The views of CAC were provided in separate discussions with Mrs. Ruth Jackson, President (Ref. V.8), and Mr. Andrew Kerekes, Barrister-Solicitor, and intervenor on behalf of CAC (Ref. V.9). Mr. Kerekes intimated that only Mrs. Jackson could actually speak on behalf of CAC, and that his views as expressed would merely be his interpretation of the goals of CAC in relation to the rate scenarios.

b. Position on Scenario A. Both Mrs. Jackson and Mr. Kerekes oppose the concept of a revenue doubling by 1978. Their opposition is based largely on their non-acceptance of Hydro's power demand forecasts and the philosophical assumptions underlying those forecasts. Specifically, Mr. Kerekes feels that "the growth rate [of demand] need not be nearly as great as projected . . .with non-voluntary checks on demand". He takes issue with what he considers "Hydro's aim for a reliability of one brownout [in] ten years, not counting for interconnections in the grid." He would prefer to see a "$1 billion dollar cutback" in Hydro's proposed rates which would result in only "eight to ten days [of possible] brownouts in ten years." Mrs. Jackson made similar comments about Hydro's forecasts being "cautious, in terms of never having a brownout." She would prefer risking a brownout "once every two or three years," rather than once in ten years.

In reference to non-voluntary checks on demand, Mr. Kerekes conceded that he "[doesn't] want the shutoff to be totalitarian." He would prefer "a diversion system" at peak hours, as a possible option in addition to peak/off-peak pricing.

One suggestion which CAC has considered is linking the 1976 rate increase to changes in the Consumer Price Index (Ref. V.10). Mrs. Jackson explained that this considera-tion was "not hard and fast," but rather one among many options. CAC's main objective is to minimize the nonessen-tial components of Hydro's rate increase, particularly having a wide safety margin at a "cost second to none." Mr. Kerekes suggested that a reduction in Hydro's rate request might come from increasing to debt/equity ratio. Pointing out Manitoba Hydro's 95% debt financing, Mr. Kerekes asserted that he did not accept Ontario Hydro's position that raising the debt financing beyond 80% would be injurious to its "financial integrity." Another means of reducing Hydro's 1976 rates was offered in his recent testimony, where he stated that elimination of the system expansion charge for 1976, pending a re-evaluation of its conceptual basis, would be "the preferable solution" (Ref. V.7).

Regarding the existing rate structure itself, irrespective of the amount of increase, Mrs. Jackson labelled the present structure as "unfair." She noted that "finding the right rates is the subject of local discontent." Philo-sophically, she felt that the optimum rate structure should "reflect the true costs [of generating electricity], including pollution." She said that" if there is too much waste in generating electricity, . . .[perhaps there should be] more direct heating with gas or oil,. . ." adding that the latter two sources should be cheaper. However, her preference for the type of home conditioning energy source would depend upon many factors, of which cost is only one. Thus, she added that there "may come a time that keeping the air clean with electricity is better."

c. <u>Position on Scenario B</u>

(1) <u>Basic Scenario B</u>. Given her assertion that rates should reflect the "true costs" of generation, Mrs. Jackson said that Scenario B "appears to be fairer." Nonetheless, she admitted that she is "unable to understand all of its implications."

Mr. Kerekes was more specific in his comments on scenario B. He stated that the CAC's current position on Hydro's demand/energy split is deriving revenues is

that the most appropriate ratio at this time is 50/50. However, as he reiterated from his testimony before the Energy Board, CAC objects to setting the demand charge so high in relation to energy charges that on-site peak generation becomes profitable to the industry (but at a disbenefit to society). He added that fuel adjustments clauses were not the proper means of determining the appropriate share of costs that should be assumed by high load factor customers.

Regarding the setting of province-wide demand and energy rates with a variable customer charge, Mr. Kerekes had mixed thoughts. He feels that "there are benefits and detriments to uniformity," although in general he likes the customer charge "because it permits accountability . . .so that no costs remain hidden." On the other hand, he maintains a philosophy that "the closer the relationship between the government and the people, the better." He has even entertained the concept of a "breakup of [Ontario] Hydro into smaller units." The overriding objective is CAC's desire to have "government close to the people, even if there are some disbenefits."

(2) Sensitivity Concepts for Scenario B. On the question of offering peak/off-peak rates for large users, both Mrs. Jackson and Mr. Kerekes were favorably disposed. Mr. Kerekes lauded this concept, and exclaimed that it "makes eminent sense if industry can do something to help everybody." He strongly favored the imposition of system peak demand and energy rates, stating: "If society decides this is the appropriate way to price energy, government has the right to force it on the people."

Both Mrs. Jackson and Mr. Kerekes favored a prohibition on bulk metering in multifamily dwellings. Both used the term "fair" in describing the impact of such a policy, and Mrs. Jackson added that it would result in a "savings to the system." However, she could not completely accept the idea that in many cases individual meters are not economical. She said that "when looking at the cost of building facilities, individual meters are worth it."

Neither Mrs. Jackson nor Mr. Kerekes had any opinion on changing the peak demand measurement, other than Mr. Kerekes stating that he is for it "if it's fairer."

Finally, they both generally favored the interruptible service based on tendered bid and probability of interruption. Mrs. Jackson recommended having a lower rate for customers with automatic cutoff devices, such as may be applied to water heaters. Those not willing to utilize such devices would simply pay the regular rate. Mr. Kerekes indicated in his testimony to the Energy Board that based on historical reserve margins, the discount provided for Interruptible A in 1976 as originally proposed "represents an unwarranted benefit for industrial customers." (Ref. V.7). Thus, he cautiously favors the idea of accepting tendered bids to reduce the reserve margin, stating that this "probably makes a lot of sense." However, he is reserving final judgement on this sensitivity concept until he has had adequate time to review its ramifications with his colleagues who are expert in this area.

d. Areas of Concern and Future Activities. Both Mrs. Jackson and Mr. Kerekes have indicated a desire to modify the long accepted association of energy consumption with the standard of living. Mr. Kerekes said he rejects the assertion that "energy consumption is directly related to the good things in life." Mrs. Jackson went further by saying that she would prefer to see the CAC Constitution alter one of its basic purposes. Instead of striving "to improve the standards of living in Canadian homes," she would rather see "to improve the quality of life [in Canada]."

Mr. Kerekes sees the role of the CAC as essentially keeping government activities honest and in the public interest. He feels that its "basic mandate is to ask quasi-embarrassing questions to check the monopoly through public participation." He does admit that the public has to learn "to live within the quality of life we can afford," even if it means less electricity being available.

The CAC will continue serving as an intervenor before the various rate hearings to be conducted by the Energy Board as well as before the new Select Committee of the Legislature. It will also be an active participant in hearings before the Royal Commission on Electric Power Planning.

4. Energy Probe

The current Energy Probe as an organization is dedicated to the social, economic, and environmental implications of energy policy. Prior to January 1975, operations in this area were conducted by the Energy and Resources Team of Pollution Probe, which itself organized in 1968. Since gaining its autonomy, the Energy Probe is no longer an

adjunct of an organization primarily dealing with pollution, but rather is now able to become involved in larger political issues.

a. Involvement in Rate-Making. While still within Pollution Probe, the Energy and Resources Team submitted a statement in 1974 (Ref. V.11) with its testimony before the Ontario Energy Board. Their testimony dealth primarily with the major issues surrounding the growth of the electric power industry throughout the Providence, as well as the types of power generating sources employed. Efforts in this area have included:

- Dissemination of public information, especially on energy conservation, and development of alternative, nonpolluting sources of energy

- Providing data gathering and research support services for energy related studies, such as Task Force Hydro 1972-3

- Assisting in the development of public participation mechanisms, culminating in the creation of vehicles such as the Ontario Royal Commission on Electric Power Planning (Porter Commission).

b. Position on Scenario A. The Probe's position was expressed mainly in terms of the philosophy underlying each scenario, given their concern with the "macro-issues" surrounding the electric power industry (Ref. V.12) In particular, Mr. William Peden, Executive Director of Energy Probe, favored the raising of bulk electric power rates substantially over the next few-years, insofar as such a measure would induce major responses in electricity conservation. Although not specifically advocating a doubling of Hydro's revenues over a three year period, he did state that "as a commodity, electricity is underpriced." His concern was mainly over the manner in which Hydro's expansion plans were developed. His feeling was that the potential for demand reductions through a variety of measures has been ignored in Hydro's growth projections. Thus, by not considering "incremental conservation programs" in planning for new capacity, Hydro's projected expansion plans become a "self-fulfilling prophecy."

c. Position on Scenario B.

(1) Basic Scenario B. While the Probe would like to see structural changes in Hydro's present electricity rates Mr. Peden's reactions to the various aspects of Scenario B were mixed. He was still sympathetic to the

idea of a major increase in electricity rates, and agreed with the proposed 35/65 D/E split, if in fact this more equitably allocated demand and energy charges to users in terms of how Hydro itself incurred costs. However, he was quite ambivalent with respect to the proposal for uniform Provincial demand and energy rates for three new customer classes. On the other hand, he favored the elimination of inequities in the present system which permit wide fluctuations among bills in different municipalities for the same electricity usage. Nevertheless, he feared the possible impacts of "more standardization" resulting in "more power [being] taken away from the citizen." The type of electricity supply/distribution system he would prefer would include "smaller thermal plants built at load centers [with the capability of] using waste heat [and] employing total energy systems." His concern over Scenario B was over the trend it might foster, as he felt that "only a decentralized [institutional] structure can even have decentralized, small scale electricity generation."

(2) Sensitivity Concepts for Scenario B. Mr. Peden generally favored all the concepts for sensitivity study except the change in peak demand measurement, as the remaining concepts seemed to discourage excess generating capacity as well as excess electricity consumption. He most favored the .15¢ peak/off peak price differential, and the prohibition of master metering in multifamily dwellings. However, he felt that a .15¢ differential may not be large enough to adequately reduce peak energy consumption. He also questioned whether peak/off peak rates should be applied only to large users; he remained unconvinced that present technology precluded the economical application of such rates to smaller users (i.e., the residential sector).

d. Future Activities and Areas of Interest. The Energy Probe's activities will continue dealing with larger issues, particularly the sources of new electric power. Mr. Peden indicated that they will continue to oppose "large scale 'energy farms' located in Southern Ontario, to supply [electricity to] urban centers." Although the Probe is "not antinuclear, per se" it would prefer to encourage alternative sources such as synthetic fuels from coal, solar power, etc. The Probe does not plan to become an intervenor in the Ontario Energy Board's 1975 hearings. Mr. Peden feels that Mr. Kerekes, who represents the Consumer Association of Canada-Ontario chapter, adequately expresses the

viewpoint of the Probe on Hydro's proposed rate structure. Instead, the Probe will focus its efforts as an active contributor to the Royal Commission on Electric Power Planning.

5. Ontario Municipal Electrical Association

The Ontario Municipal Electrical Association (OMEA) is the political offspring of several municipal power unions, beginning with the Niagara Power Union, an interest group formed in 1906 which lobbied for public ownership of electric power. OMEA was formed in 1912 to provide an organizational partnership among the municipalities, in extending hydro-electric service throughout the Province. Its primary objectives are:

- To provide a common voice on behalf of the municipalities on all matters involving hydroelectricity (no longer restricted to hydro)
- To unite municipalities in the purchase of electric supplies, and to obtain a standardization of equipment, accounts, operation, and general management of municipal plants
- To work in conjunction with Ontario Hydro in promoting electrical development of the Province
- To promote the interests of the municipal utilities and to prevent any encroachment on the rights of the municipalities (such as charters and water rights sought by private companies to develop power for profit)

a. Involvement in Rate-Making. As the political arm of the municipalities, OMEA has long been active in all matters involving the sale and distribution of electric power in Ontario. It has recently served as an intervenor in both the 1974 and 1975 rate hearings before the Ontario Energy Board. Technical support for its testimony is provided mainly by the Association of Municipal Electric Utilities, but the positions espoused are determined through a polling of those member utilities which pay dues to OMEA. Member utilities in the minority on specific policies are then free to resign from OMEA (as has North York Hydro in the past year), if the majority opinion is considered not in the best interest of that municipal utility.

b. Position on Scenarios. The scenarios presented and discussed with the other parties at interest were presented to OMEA for review (Ref. V.13). However, the OMEA indicated

that, due to commitments in preparing its testimony before the Select Committee of the Legislature on Hydro's rate proposal, it was not available for comment at this time.

6. Sierra Club

Sierra Club of Ontario is incorporated as a non-profit corporation under the laws of the Province. As a conservation group, its prime concern is the protection of wilderness and open space. Although the subject of bulk power rate structures has only an indirect bearing on the environment, Sierra's concern over Hydro's expansion program arises from its fear that current growth plans do not adequately account for a new awareness of the value of energy conservation.

a. Involvement in Rate-Making. The Sierra Club has already expressed its concern through testimony in 1974 before the Ontario Energy Board (Ref. V.15 and V.15). The testimony focused on two major areas of concern which affect bulk power rates (mainly through the amount of total revenues required by Ontario Hydro, rather than by the actual structure of wholesale pricing to direct customers). Mr. Richard Symmes, Chairman, Sierra Club of Ontario, expressed these concerns as follows: (Ref. V.16).

(1) The absolute number of electricity generating facilities required to provide power throughout the Province
(2) The mix of generating plant types, and the relative environmental consequences associated with each type of generation facility

limitations in challenging Hydro's load forecasting conclusions, it does not totally accept the necessity of "doubling (capacity) every 10 years." Its 1974 testimony also noted a concern with the problem of radioactive waste disposal, associated with an "everincreasing reliance upon nuclear generation. . ." Other areas addressed at that time included the somewhat low efficiency of Hydro's generating facilities (about 30% usuable energy from raw source to end use), and the question of electricity export to the U.S. as a factor in load planning.

b. Position on Scenario A. The Sierra Club is generally in favor of increasing bulk power rates for the purpose of discouraging electricity consumption, although it has no formal position on how much of a rate increase may be justified. Mr. Symmes feels that, ideally, electricity bills should reflect that usage patterns of individual customers. Pricing incentives could be used to change power consumption patterns and thereby reduce peak power demands as well as total

electricity consumption. Mr. Symmes would like to see such demand or energy reductions reflected by commensurate reductions in each customer's bill. He expressed disfavor with Scenario A, since it provides no such incentives and merely perpetutates a structure where end users with the same total electricity consumption may pay bills varying up to 30% among the municipalities.

c. Position on Scenario B

(1) Basic Scenario B. Mr. Symmes agreed that the demand and energy charges by Ontario Hydro to its direct customer should reflect the relative proportions of its own total costs as they are incurred. He especially favored uniform provincewide demand and energy rates based on customer class, rather than the existing system. These changes were perceived by him to be "more representative of usage patterns" by individual customers, and therefore would be more equitable and would promote conservation.

(2) Sensitivity Concepts for Scenario B. Mr. Symmes was very favorably disposed to the concept of peak/off-peak rates for large users. He agreed with the philosophy of providing separate incentives to reduce both peak demand and energy rates, via the concepts of using a strictly peak period demand measurement and an off-peak differential. However, his major criticism was the exclusion of non-industrial customers from being offered these incentives, particularly the energy price per KWH differential. In the latter case, he questioned the alleged economic inefficiency of administering off-peak rates for small users. His opinion was that in the long-run, an off-peak rate recorded through individual metering may well pay for itself.

Mr. Symmes was somewhat negative but basically uncertain of the impact of changing the peak demand measurement period from 20 minutes to one hour. He felt that this might encourage peak power demands by making it cheaper than at present. However, when appraised of the engineering rationale for this change (a more accurate correlation between sustained demand and need for more capacity), he was no longer as adamantly opposed to this concept.

Of all the concepts for sensitivity considered, the most favorable response was elicited with respect to the prohibition of master metering in multifamily dwellings. The Chairman voiced a "strong positive" for this policy. He felt that even if the administrative costs of individual metering were determined to be "somewhat beyond economic justification," the "long run

benefits" of such a policy might be worthwhile in terms of the "conservation ethic" that would be fostered.

Mr. Symmes had ambivalent thoughts on the concept of providing interruptible service based on a tendered bid for a given probability of interruption. As a means of allowing Ontario Hydro to essentially "purchase back" its reserve capacity through lower cost interruptible service, he was very favorable. Nonetheless, he questioned the purpose of having a tendered bid, preferring instead a "public schedule" of rates at given probabilities of interruption open to all. His criticism in this regard was that "Hydro tends not to interrupt", and thus a bid system may keep the reserve margin too wide. He wants to see "the reserve margin close enough to have it (i.e., service interruption) actually applied."

d. Areas of Concern and Future Activities. Sierra Club of Ontario will continue to be active in the movement to reduce present growth trends of electric power throughout the Province. Among the areas in which Mr. Symmes feels that his Club would like to see innovations, are those involuntary shutoffs and differential rates by type of heating. As a measure of controlling peak usage, automatic shutoff devices could be employed (either remote or on-site) to disconnect hot water heaters, dishwashers and other non-essential appliances during system peak periods. Also, lower KWH rates could be offered as an incentive to homes equipped with shutoff devices or, equally valuable, with heat storage facilities. Mr. Symmes felt that significant contributions to load shifting can be made if appropriate incentives are provided.

Mr. Symmes was uncertain about the possibility of further testimony before the Energy Board following the Costing and Pricing Study. However, the Sierra Club has submitted a statement on November 13 to the Royal Commission on Electric Power Pricing, (Ref. V.17), which called upon Hydro to promote energy conservation and thereby disprove its own forecasts. Among the specific measures Sierra has recommended for Hydro to adopt in achieving conservation is to stop promoting electric heating in homes, and to abolish all special low rates for electricity. The Sierra Club will remain an active contributor to the Royal Commission and thus will continue its involvement with bulk power rate through this forum.

7. Urban Development Institute

The Urban Development Institute (UDI) is a nationwide, independent, nonprofit organization representing the real estate and building development industries. Members include land and property developers; owners and managers of commercial, industrial and residential properties; financial planners; utilities; land planners, engineers, achitects, lawyers and other consultants in related fields; and investors. UDI of Ontario was formed in 1957 as the first provincial branch. As a recognized channel of communication between government agencies and the business community, UDI strives toward the goal of an improved urban and community environment primarily through its working committee sessions. Its committees regularly meet to examine industry-related subjects ranging in areas such as mortgage financing, building and occupancy standards, pollution problems, and taxation policies.

a. Involvement in Rate-Making. The Urban Development Institute has not in the past been actively involved in rate-making proceedings. UDI's General Manager, Mr. Peter Erhardt, expressed an interest in having his organization become more involved in utility planning efforts when such plans may impact the build development industry. The major area of concern to UDI is the hypothetical policy option of prohibiting future bulk metering in multifamily dwellings. Primarily for this reason, UDI has been considered a potential party at interest.

The views of UDI and the development industry were solicited in a combined interview with Mr. Erhardt and Mr. Richard Harris, Vice President of Greenwin Property Management. (Ref. V.18).

b. Position of Scenario A. Not having been involved in rate-making previously, UDI has no formal opinion on the existing rate structure, or on Hydro's proposed revenue doubling by 1978. Mr. Erhardt deferred most questions requiring a response from an active developer to UDI member Richard Harris. Mr. Harris expressed his personal opinion that the public is not ready to accept a rate increase of this size, particularly with wage-price guidelines in effect. Mr. Erhardt has no specific response to Scenario A, other than concurring in his uncertainty over public acceptance of such a rate increase.

c. Position on Scenario B

(1) Basic Scenario B. UDI, has no formal opinion on the basic new rate structure as described.

(2) Sensitivity Concepts for Scenario B. Both Mr. Erhardt and Mr. Harris agreed that offering peak/off-peak demand and energy rates only to large users made the most sense as an effective policy innovation. With regard to offering such rate incentives to the residential user, unless the price differential was an order of magnitude apart (as in Vermont's experimental pricing program), little shift in residential power demand was deemed likely. Mr. Harris said that he "can't see that it would make a bit of difference, with the (price) difference offered here" (.15¢ per KWH less for off-peak usage extended to residential users as well).

In reference to the concept of prohibiting bulk metering in multifamily dwellings, Mr. Harris responded unequivocally that "developers almost unanimously would favor individual metering." The reasons he cited for his perception of uniform developer support for this measure are as follows:

a. Foremost, this would reduce the rent bill per unit, making individually metered units more attractive to tenants

b. Discretion would be welcomed by most tenants; however, a mixed reaction may be expected as some residents would have the "aggravation of one more bill to pay," still, this would improve the present situation where it remains "somewhat inequitable for Tenant A to pay for Tenant B's flagrant use of electricity."

c. Finally, this would "reduce energy consumption," which although not directly a burden to developers, is nonetheless a matter of concern to many of them.

Mr. Harris, also asserted that condominium owners would "definitely prefer individual meters."

One significant and somewhat unexpected potential impact was considered possible (if not likely) following a prohibition of bulk metering. This is the possibility of unintentionally providing an impetus toward more electricity conditioned units in lieu of other energy sources. Mr. Harris felt that such a prohibition "might encourage developers to go with electric heat," since natural gas heated units almost always are bulk metered. As the predominant trend is gas heating from cental boilers "in multifamily dwellings, the attractiveness

of individual electricity meters in renting units might pursuade developers to select electric heating over natural gas, providing that other economic considerations to the developer are minimal.* However, any rental advantage of individually metered electric units would still be subject to overall cost differences among electricity, natural gas, and fuel oil, as well as the future availability of natural gas to the residential sector.

When informed that collection costs and bad debts were among the primary arguments against individual metering, Mr. Harris dismissed this point with his belief that "collection costs cannot escalate as fast as energy costs." As a final response on this question, Mr. Harris added "I don't think that it (prohibition on bulk metering) would have any affect on the rate of development (in the Toronto area)."

Neither Mr. Erhardt nor Mr. Harris had comments on the other sensititivity concepts, which are of comparatively little concern to UDI or the development industry.

d. <u>Future Activities and Areas of Interest</u>. Mr. Erhardt expressed an interest in becoming more involved in electric utility planning insofar as it may affect urban growth and development. Specifically, he is willing to act on behalf of UDI to provide assistance to Hydro, by serving as a liaison for future communications between Hydro and the development industry.

B. Summary

Many of the viewpoints expressed by the parties at interest in response to the rate scenarios may be considered conceptual interpretations based on each organization's objectives and philosophy. Several of the parties have indicated that more specific responses would be possible at some time in the future. In such cases, further consideration may be directed toward evaluating the various scenario

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* *This view was corroborated in a subsequent discussion with Mr. Donald Flemming, Planning Director for Whitehall Development Corporation, Ltd. (Ref. V.19) Mr. Flemming cited the recent elimination of the $200 per unit rebate previously offered to developers by Consumer's Gas Company for initially connecting with its natural gas delivery system. If this type of promotional advantage of natural gas is discontinued Province-wide, individually metered electric units may gain a distinct advantage in the multi-family rental market.*

concepts when such groups are preparing new testimony for delivery before the Ontario Energy Board or before the Royal Commission on Electric Power Planning.

Table V-1 presents a matrix of the parties at interest and their responses to the rate scenario concepts as discussed above. This provides a concise comparison of interest group opinions based on personal interviews and prior testimony. Past participation as an intervenor in the 1974 and 1975 rate hearings before the Ontario Energy Board is also indicated where applicable.

Some interesting observations may be made in comparing the attitudes and values of certain group representatives. Of the three parties associated with the consumer/environmental constituency (i.e., Consumer Association of Canada, Sierra Club, Energy Probe), only the CAC has acted as an intervenor before the Energy Board in 1975, and plans to do so again on this matter when the occasion arises. Neither the Sierra Club nor the Energy Probe has been an intervenor since 1974, and neither has any such plans for 1976. Non-intervention in both of these cases has been explained by two factors:

(1) Limited time and monetary resources to expend for this type of activity.
(2) A greater desire to deal with the "larger issues" affecting the electric power industry, such as future growth in electricity consumption, the long term potential for conservation measures, and the types of generation sources most desirable for new power plants.

Given these factors, both Sierra Club and Energy Probe have deferred participating directly in any new round of rate hearings; instead, the efforts of both groups have concentrated on providing testimony before the Royal Commission on Electric Power Planning, chaired by Mr. Porter.

One result has been that the Probe has considered the views of CAC as similar enough to its own such that the testimony of the latter in any new rate hearings may be considered as representative of both groups. Yet on closer observation, the views of these groups are not entirely coterminous. The Probe, on the one hand, feels that "electricity is underpriced" and has intimated its approval of substantial rate increases over the next few years in the interest of discouraging electricity consumption. The CAC also advocates reduced consumption; however, it prefers involuntary cutbacks in peak power availability, over the free-market mechanism of achieving demand elasticity through higher rates. On this issue, Sierra Club appears more inclined toward the position of Probe.

TABLE V-1. RESPONSES OF PARTIES AT INTEREST TO SCENARIO CONCEPTS

Scenario Concepts / Parties at Interest	Scenario A	Scenarios A&B	Basic Scenario B			Sensitivity Concepts for Scenario B				
	Maintain Existing Rating Structure	Increase Bulk Rates Amounting to Revenue Doubling in 3 Years	Modify Demand/Energy Split to Achieve 35/65 Ratio	Establish Uniform Provincial Demand and Energy Rates	Establish Discretionary Customer Charge Allowing Municipal Utilities to Meet Revenue Requirements	Provide Peak/Off-Peak Rates For Large Users: Non-Coincident Peak Demand Measured Between 700 and 2300 Hours	Provide Peak/Off-Peak Rates For Large Users: .15¢/Kwh Peak-Off-Peak Price Differential	Change Peak Demand Measurement From 20 Minutes to One Hour	Prohibit Master (bulk) metering in Multi-Family Dwellings	Interruptible Service Based Upon Tendered Bid and Probability of Interruption
*Association of Major Power Consumers of Ontario	mixed; position on existing structure depends on the nature of alternative structure	moderately opposed; favors sizeable rate increase but feels that revenue doubling is excessive	opposed; disagrees with methodology used to justify 35/65 ratio	favors in principle	uncertain	highly favorable; believes this can offer savings to some industries and also help curb demand	favors in principle but not sure if differential is adequate	favors in principle	favors in principle	mixed, favors principle of expanding interruptible service but uncertain if this is best method
**Association of Municipal Electric Utilities	mixed; position on existing structure depends on the nature of alternative structure	favors; necessary for adequate maintenance and expansion	favors in principle; uncertain about modifying all the way to 35/65 ratio	favors in principle	favors in principle; wants clarification on how derived and on municipality discretion in establishing customer classes	favorable but uncertain over ability to achieve load improvement		favors in principle	mixed; recognize consumer demand for individual meters but fearful of costs, especially bad debts	favors in principle
*Consumers Association of Canada, Ontario Provincial Association	mixed, favors elimination of rate inequities, but opposed to centralized utility decision-making	opposes; prefers non-voluntary checks on demand	favors over present situation but prefers 50/50 D/E split	mixed; for reasons cited under 1st column	favors in principle	highly favorable but unconvinced that peak/off-peak energy rates cannot be offered economically to small users		uncertain	highly favorable	conditionally favors; wants reserve margin reduced
‡Energy Probe	mixed, favors elimination of rate inequities, but opposed to centralized utility decision making	uncertain on size of increase; favors using rates to discourage consumption	favors in principle	mixed; for reasons cited under 1st column	uncertain	highly favorable but unconvinced that peak/off-peak energy rates cannot be offered economically to small users		opposes	highly favorable	favors in principle
*Ontario Municipal Electric Association	unavailable for comment	generally‡ favors substantial rate increase if necessary to maintain current debt/equity ratio and service expansion plans	unavailable for comment	unavailable for comment	unavailable for comment	unavailable for comment		unavailable for comment	unavailable for comment	unavailable for comment
‡Sierra Club of Ontario	opposes, desire to have electricity bills reflect usage patterns of individual consumers	uncertain on size of increase, favors using rates to discourage consumption	favors in principle	highly favorable	uncertain	highly favorable but unconvinced that peak/off-peak energy rates cannot be offered economically to small users		initially; opposed; presently uncertain	highly favorable	conditionally favors; uncertain of tendered bid aspect; wants reserve margin reduced
†Urban Development Institute Ontario	no formal opinion	no formal opinion	no formal opinion	no formal opinion	no formal opinion	favors in principle		no formal opinion	highly favorable; raised prospect that this might encourage developers to "no electric"	no formal opinion

*Intervenor Before Ontario Energy Board on Rate Hearings in 1974
**Intervenor Before Ontario Energy Board on Rate Hearings in 1974 and 1975
†Non-Intervenor
‡Derived solely from 1975 testimony

The differing mechanisms preferred by these groups to achieve similar ends reflect the differences among their constituents and priorities. Since the number of constituents of Energy Prove and Sierra Club are relatively fewer (and therefore more attitudinally cohesive), environmental protection and energy conservation remain the highest priorities. By contrast, the CAC has a much more numerous and diversified constituency. Hence, the top priority must be a common denominator among all of its members: maintaining the consumer's interest and living standard through a continued supply of low-priced electricity.

The CAC and AMPCO are effectively allied as the parties most opposed to the concept of revenue doubling within three years. Both groups challenge the system reserve margin being sought as excessive and unrealistic, given the growing public concern over rising energy costs and the need for conservation measures.

Among the various components of both scenarios, two sensitivity concepts stand out as having virtually unanimous support by the parties at interest: providing peak/off-peak rates for large users, and prohibiting the bulk metering of multifamily dwellings.

In the case of peak/off-peak rates, it should be noted that little distinction was made between the demand measurement and the energy price differential concepts by certain interest groups. Those groups with consumer or environmentally-oriented constituencies were neither fully aware nor deeply concerned with the economic rationales behind these sensitivity concepts. Since residential and commercial class users would be unaffected by these options as defined by Scenario B, the most detailed viewpoints were expressed by AMPCO and AMEU. For the other groups, interest in peak/off-peak measures remained largely philosophical and focused on making such options available to smaller electricity consumers.

With respect to a prohibition of bulk-metering in multifamily dwellings, again, the views of most groups concentrated on providing the right signals to as many consumers as possible. Such favor was often expressed with partial disregard and sometimes even disbelief over the economics of administering such a program. Thus, public sentiment is currently favorable toward if not fully cognizant of, the potential benefits of these two major discretionary conservation options (i.e., peak/off-peak demand measurement and energy pricing, and individual electric metering in multifamily dwellings). If this sentiment continues, there will be growing pressure to provide all consumers with a direct opportunity to save money for themselves and for the utilities by altering their individual electricity consumption patterns.

Perhaps the most controversial scenario concept as discussed previously is an extension of the present dispute over the 1976 proposed rate increase - the concept of a revenue doubling by 1978. To the extent that new industry growth is dependent upon the future availability of inexpensive power, reduced system capacity to curtail rising electricity costs may achieve mixed results. Whether reduced capacity might affect the expansion plans of existing industries, or possibly even restrict the market entry of new industries is highly uncertain.

The proposed change in the demand/energy split to 35/65 could also gain a similar prominence as an issue. AMEU and CAC have expressed reservations over the magnitude of this shift, and AMPCO is likely to make known its specific objections to the criteria under which the proposed ratio was derived.

Those concepts which the interest groups understood least and therefore desire detailed clarifications on, are the customer charge and the interruptible service (by tendered bid) options. On the customer charge, much uncertainty and concern has been expressed over the basis for differences in Hydro's customer charge to municipal utilities, as well as the type of guidelines under which a utility can utilize this charge to recover its own revenue requirements. On the interruptible service option, the primary concerns are also twofold. They arise over the extent to which the system reserve margin can be reduced, and also with respect to ignorance over the prospective savings which might become available to prospective customers under realistic interruptible service prices which may result from this option.

Finally, of the numerous impacts which may be associated with implementing or not implementing certain of the scenario concepts, two indirect impacts are worth considering for their potential consequences. These are the indirect impacts that may be associated with:

(1) Cutbacks in municipal utility services over the next few years.

(2) Inadvertently promoting electric heating in new buildings by prohibiting bulk metering in multi-family dwellings.

In the first case, municipalities may be forced to curtail customer services such as renting hot water heaters, or impelled to reduce operation and maintenance expenses even if outage periods increase. The cost of consumer purchases of new water heaters and the costs to Ontario

businesses of slower power restoration service may be causes for concern, at least in the short term.

In the latter case, the probable attractiveness of individually metered electrically heated units as against alternative power sources (i.e., bulk metered natural gas units), may encourage developers to "go electric" wherever feasible. Unless natural gas becomes substantially less expensive than electricity in the near future, such a policy as banning new bulk electric meters may prove to be quite promotional of electricity consumption. This, in turn, may have consequences for the growth rate of electric power in the long term.

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V.13 Interview with Mr. Edwin Nokes, Executive Director, Ontario Municipal Electrical Association, October 27, 1974.

V.14 "Submission of the Sierra Club of Ontario" Ontario Energy Board Hearings, System Expansion Program, 1974.

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ELECTRICITY COSTING AND PRICING STUDY

VOLUME XB
IMPACT STATEMENT: SECTORAL STUDY AND INTERNAL CASE STUDIES

Ontario Hydro
October 1976

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INTRODUCTION

This study attempts to assess how raising the price of electricity and changing the rate structure would affect industry. Because of the limited time and data available, only nine industries, using fairly large amounts of electric power per unit of output are selected for in-depth analysis. In this study the words electricity and energy are not used interchangeably. The term energy is used to signify all forms of commercially available energy such as gas, oil, and coal.

A. EFFECTS OF INCREASING RATE LEVELS FOR ELECTRICITY

1. Short Run[1]

All industries in Ontario face increasing electricity costs. But some consume more electricity per dollar of output than others; and on them, obviously, the rate increases would have a greater effect. Thus these industries (some critics claim) would be at a disadvantage in competing, whether with domestic producers of other products or with foreign producers of the same products. Close inspection proves this claim to be overstated. For it is derived from a static model: in other words it assumes nothing would change except the price of electric power, whereas in reality other variables keep changing too. Wages, for instance, which are often the largest component in production costs, are climbing too. Moreover, the producer can often use electric energy more efficiently and so cut back his demand for it; he can also raise the price of his product, though only of course, as much as the price elasticity of demand allows. Similarly one must take care when discussing foreign competition. Energy scarcity is a problem in every industrialized nation; producers in other countries are not immune from its impact either. In the short run, Canadian energy prices generally will approach world prices, starting from a level which is now below U.S. prices.

Although this paper seems to focus on the effects of increased power rates on employment and on industries' plans to relocate, the adjustments through which an industry copes with cost increases (conservation, wage reductions, and price) are discussed throughout. The finding was that the increase in rates for electricity forecast in 1975 (75.9 per cent over the years 1976-1978, or about 40.0 per cent in real terms)[2] may cause the industries to discharge about 1048 hands, or about 2.7 per cent of their 1972 workforce. In seven of these industries, however, the historic trend of rising employment may save 580 of these jobs. On the other hand, our analysis of the determinants of industrial relocation (and location) shows little tendency for the industries to relocate. What we can draw from these results, then, is this: *In view of the minimal effect they impose on most electrically-intensive industries, rate increases are not expected to exert any significant impact on industries which use far less electric energy as a percentage of value added; similarly, the effects on the Ontario economy as a whole are expected to be minimal.*

2. Long Run[3]

As this study has confirmed, a higher price for electricity could result in fewer jobs in the power-intensive industries. Taken by themselves, however, these losses overstate the impact of an increase in the power rates on employment, since it is likely that the jobs eliminated in one sector of the economy would be counterbalanced somewhat by new jobs in others. One must therefore distinguish between a structural shift in employment opportunities and an absolute decline in available jobs. To put it another way, there may be a shift within Ontario manufacturing away from the energy-intensive industries, as a group, and towards the less energy-intensive industries, because the relative rise in energy prices favours the latter as compared with the former.

Despite its energy deficiency[4] (compared to Alberta, British Columbia, and Quebec), Ontario will remain, by and large, a favourable location for industries. This is simply because established industrial centres do not normally decline just because their electricity and other energy grows dearer.

In most industries, electricity costs form a very small percentage of overall production costs. Factors such as costs and availability of raw materials, labour and transport costs, and proximity to both commodity and financial markets[5] are usually more important for determining plant locations.[6] An examination of these factors shows that Ontario retains the advantages it has so far enjoyed. In other words, new industries, and plants of existing industries (mainly less energy-intensive ones), will continue to choose to locate in Ontario. One can foresee the establishment in Ontario of industries manufacturing energy-saving and anti-pollution equipment (given that many research centres are located here), and the expansion of uranium mining. These new industries would provide alternative opportunities for employment, and so offset the immediate loss of jobs owing to higher prices for electricity. Excepting uranium mining, Ontario will also avoid the negative social and environmental impacts associated with large scale oil extraction and coal mining.

Past experience of economic development in various industrial countries shows the importance of the tertiary sector, which is labour-intensive. In the take-off stage, the manufacturing sector contributes the largest employment growth, but the increase of employment in the tertiary sector exceeds the increase in employment in industry when an economy matures. Indeed, the service industries employ over half the Canadian work force. That being so, one can predict that alternative opportunities for employment will appear in these sectors as the provincial economy matures further in the 1980s. The recent and anticipated increases in fuel prices should accelerate the process, as energy-intensive industries adopt energy-saving technologies.

B. EFFECTS OF CHANGING RATE STRUCTURES

1. Short Run

It is argued that the present rate schedule does not adequately reflect the actual cost of producing electricity. A four-part tariff is proposed in its place. The new system, based on marginal-cost pricing, would differ from the prevailing one in two important

[1]The concepts 'short' and 'long run' are a very useful theoretical tools. But then the question arises, How long should a short (or a long) run last? For analytical purposes, the short run as defined here is arbitrarily confined to the time horizon from 1976 to 1978, and the long run is the years beyond.

[2]The figure 75.9 per cent merely represents the nominal increases in the power rate forecasted. Now let us use the annual changes in the Consumer Price Index (CPI) as a proxy for inflation. The anticipated increases in average annual CPI levels are as follows: 1976, 8.7%; 1977, 7.5%; 1978, 7.5%. The total increases in the CPI, therefore, are 25.6 per cent over the 1975 level. If one assumes the price of electricity to be fully indexed, the real increases in the power rate will be 40.0 per cent (75.9% - 25.6%).

[3]Readers should notice that certain statements made under this heading are relevant to the short run to some extent.

[4]With the exception of uranium.

[5]Ontario's large population, which has the highest total real income in Canada, provides the largest domestic market on the one hand, and the adjacent New York State provides an equally attractive foreign market on the other. Similarly, Ontario and New York are financial centres of Canada and the United States, respectively.

[6]It must be emphasized that energy prices are rising in other jurisdictions as well.

ways. Firstly, it would place more emphasis on the energy charge, and second it tracks time variations in costs.

On-peak users of electricity, now subsidized by off-peak users, would have to pay a higher rate under the new system; off-peak users, on the other hand, would pay a lower rate because the total costs of producing electricity are lower off the peak. It follows therefore that if the producer wished to maintain a least-cost operation, he would need to make the best use of the off-peak provision. Some of the measures he would need to take are reshuffling work to night or weekends, rescheduling the electrially intensive parts of operation to off-peak hours, and, at a time of slack market demand, maintaining off-peak operation while cutting back on-peak operation. Iron foundries, for instance, could conceivably benefit from the new rate structure. Because of a low use factor compared to installed capacity, and the operation of one shift, these plants should have no great difficulties in relocating much of their electrically intensive production processes to off-peak hours. However, this flexibility would not be economically available to most power intensive industries, at least in the short run. Many would have to pay a little more.

2. Long Run

The longer the time horizon, the greater the adjustments will be. To take the full advantage of peak load pricing, the producer can presumably undertake to expand his plant capacity. The question then becomes, Does the benefit justify the cost? As it turns out, it often does not pay to build excess plant and then use it part-time only.

As was noted above, the proposed new schedule is derived from economic theory, and would attempt to convey as much relevant cost information as was practical. When given the correct price signal, the customer, would decide on a level of use that minimize his costs or maximize his utility. This demand information in turn would feed back to the system planners, who would then decide on optimal load growth and generation mix accordingly. The resulting consumption and production patterns would thus lead to an efficient allocation of the resources devoted to producing electricity.

Implementing marginal-cost pricing might give Ontario an advantage over jurisdictions that did not do so. The reason is simple. Each jurisdiction is endowed with certain resources at any time, and these have to be allocated between the energy sector and other sectors in the economy. Therefore, if electricity is produced beyond the socially optimal amount as a direct consequence of improper pricing, too few resources will be allocated to potentially more desirable activities. The new rate structure, if properly effected, would mitigate this danger.

The accompanying diagram illustrates the development of this chapter.

The Impact of Electricity Pricing on Electrically Intensive Industries
- To Determine the Impact of a Rate Increase and Structure Change on The Industries in Ontario

Effects of the Rate Structure Change
- To Determine the Effects of Implementing Rate Scenario B in the Industry Sector

Economic Foundation of Scenario B
- The Purpose of the New Rate Structure

Impact of Scenario B
- To Evaluate the Pro's and Con's from the industries' point of view

Cost & Benefit
- Examine the Cost Involved to Take Advantage of the Off-Peak Pricing Benefits

Qualitative Assessment
- An Assessment of the Types of Plants that Could Take Advantage of the MCB Rates

Conclusion

Effects of a Rate Increase
- To Determine the Impact on a Rate Increase by Testing Various Assumptions for the Industry (Emphasis on Employment)

Maximum Employment Effects
- The Upper Bound of Loss of Employment, Assuming Everything Else Constant
- Any Increase in the Cost of Electricity is Absorbed by a Loss of Employment With Constant Output and Prices

Revisited Assumptions
- Relaxing Individual Assumptions to Reflect the Most Probable Effect
- To Determine a Qualitative Assessment of the Most Probable Effect

Demand for Output
- An Examination of Elasticity of Demand Future Growth and Profits for Each Industry.
- The Object is to Determine How Easily The Manufacturer Can Absorb the Increase Cost of Electricity

Conservation
- A list of Different Ways to Conserve Electricity

Downward Wage Rigidity
- Real Wage Rates and Their Effect When There is a Low Demand for Employment

Factor Substitution
- A Mixture of Inputs and How They Might Change With a Relative Increase in Energy Costs

Fuel Substitution
- To Compare the Relative Prices in the Future of Fuels

Sum Up
- To Estimate the Effect of the Rate Increase on Specific Variables

Conservation
- A List of Estimated kWh That Could be Saved for Each Industry Group

Selling Price
- A List of Estimated Jobs Retained and the Portion of the Added Electrical Cost born by the Customer for each Industry

Factor Substitution
- Possible Jobs for the Industries with Basic Assumptions

Wage Adjustments
- The Importance of This Adjustment in the Industrial Labour Market

Employment Trend
- An Estimation of the Employment Trend in the Industry

Conclusion - Impact on Employment

Industrial Relocation (Due to a Rate Increase)
- To Determine the Likelihood of Relocating by Examining the Factors Involved

Demand Elasticity for Outputs
- Which Industries are More Likely to Absorb the Increase Electrical Costs & Therefore more Likely to Consider Relocation

Electricity Cost as a Proportion of Total Costs
- Evaluating if in the Future the Cost of Electricity will be a Large Factor in the Industry's Total Value Added

Availability of Cheaper Electric Energy in Other Jurisdictions
- To Determine how Ontario Electricity Costs Compare with the Other Provinces

Advantages of Existing Locations
- A List of Advantages of Certain Locations

Conclusion

Concluding Remarks

II. THE IMPACT OF RATE INCREASES AND A CHANGE IN RATE STRUCTURES ON INDUSTRY IN ONTARIO, 1976-1978

A. PURPOSE OF STUDY

This chapter focuses mainly on the short-run effect of rate increases on employment in the Ontario manufacturing-industries, and on plans of existing industrial establishments to relocate.[7]
Since a comprehensive study covering every industry in the province was beyond the scope of the report, only several electrically intensive industries were chosen for study in depth.

Section A-1 outlines the theoretical perspective. Section B assesses the maximum possible effect rate increases could have on direct employment. Since these estimates were initially made under a set of restrictive assumptions, an attempt is made to modify them in Section C, which presents revised estimates representing 'most probable' effects. Section E briefly discusses the potential effects of a change in rate structures on the industries. Apart from its effect on employment, a higher price for electricity might induce firms to relocate to other places where electricity was relatively cheap. Section D is devoted entirely to investigating this potential for relocation. A brief discussion of the limitations of the results concludes the chapter.[8]

Section A-1 gives the economic optimum for inputs, including electricity that a company would use in production. This theoretical approach is a useful perspective within which the practical approach to the problem should be viewed (see Section B).

Theoretical Perspective

Together with capital, labour, and raw materials, energy constitutes a basic ingredient of the manufacturing-process. Let the following be the production function: $Q = f(K,L,Z,E)$, where

1. Q = quantity of output,
2. K = units of capital,
3. L = units of labour,
4. Z = vector of raw materials used, and
5. E = vector of energy consumed.

The E vector contains all energy inputs employed in production: including natural gas, oil, and electricity. While each kind of energy contributes in one way or another, this study is concerned mainly with electric power. In theory, each factor of production should be used up to the point where its marginal product per dollar's worth equals the marginal product per dollar's worth of any other factor.

Marginal product of factor A/Price of factor A = Marginal product of factor B/ Price of factor B = ... = Marginal product of factor Y/Price of factor Y.[9]

Note. The marginal product is the increase in output that results from increasing the amount of an input by one unit, the amounts of all other inputs remaining the same.

Other things being equal, an increase in the price of electricity, will throw this condition out of equilibrium, and readjustment will necessarily follow. To illustrate, suppose only two inputs are used in production, electric power and labour, so that in equilibrium $MPP_E/p_E = MPP_L/P_L$

where

1. MPPi = Marginal physical product of input i,
2. E = Units of electricity,
3. L = Units of labour, and
4. P_i = Price of input i

Note. The marginal product of an input is defined in terms of physical units of output. It is therefore often called the 'marginal physical product' or 'MPP'.

Now suppose the price of electricity increases while the wage rate remains constant, as a result of which $MPP_E/P_E > MPP_L/P_L$.

In order for the condition to return to equilibrium, either MPP_E must go up, or MPP_L must go down, or both. The requirement is fulfilled when the producer employs less electricity and/or more labour; and the result is a declining physical product.

B. MAXIMUM EMPLOYMENT EFFECT

Although the electricity costs of the nine electrically intensive industries are projected to 1980 on the basis of 1972 and 1973 spending, this analysis will centre on 1976-1978. Before considering the methodology, one should keep in mind the assumption that, initially, the whole impact of increased costs for electricity would be absorbed by decreasing the outlay on labour. That is to say, despite a higher price, the producer decides to take the same amount of power, and to pay for the added costs, he reduces his outlay for labour by an equal amount. Yet owing to unexplained variables, he manages to maintain his previous level of output with fewer employees. Furthermore, we make the following assumptions:

1. No change in profit margins;
2. No conservation measures;
3. Downward rigidity in wages;
4. Absence of substitution between factors;
5. No effect on product prices; and
6. No demand growth and no change in market share.

The nine industries chosen for analysis are listed in Table B-1. (Table B-2 surveys the intensity of electricity use in various industry groups.) An examination of these statistics reveals an interesting feature of the Ontario manufacturing sector, which in 1972 consumed more than 24.5 billion kWh, representing about 35 per cent of all the electricity Ontario Hydro and the associated municipal utilities sold[10] The nine electrically intensive industries accounted for 8.7 per cent, of total value added (a rather small share), and similarly employed a small fraction of the total number of employees in Ontario manufacturing (only 7 percent); but they used 47 per cent of the total electricity that sector purchased. As an educated guess, the abrasives industry might be the one most affected by any rate increases, because in 1972 electricity costs were equivalent to almost 19 per cent of its value added (for the eight other industries in the group, the figure is below 10 per cent).

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[7]What conclusions we draw can also be applied to new entrants into the industries They are more mobile than the existing industrial establishments in that none of their capital has been committed

[8]The purpose of the study, as mentioned above, is to investigate the effects of rate increases on the Ontario manufacturing sector. Little will be said about the kind of response which an industrial establishment makes to cope with the situation; instead, major attention is paid to the overall impact of power rate changes on the economy. The reason is that case studies on a microeconomic level have been reported in the Hittman Report.

[9]The mathematical derivation of the equilibrium condition may be found in any standard economic textbook

[10]Ontario Hydro, *Utilization and Conservation of Electricity in Industry in Ontario*

Personal Income Per Capita in Each Province As Percentage of National Average, 1960-71 — TABLE B-1

	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC	Y & NWT	Canada
1960	56	57	76	68	87	118	99	89	100	115	106	100
1961	58	59	78	68	90	118	94	71	100	115	97	100
1962	56	60	76	66	89	117	98	93	100	112	88	100
1963	56	58	75	67	89	117	94	98	98	112	84	100
1964	57	61	76	68	90	117	96	85	96	113	86	100
1965	59	60	75	68	90	116	94	90	97	114	80	100
1966	60	60	75	69	89	116	92	93	100	112	81	100
1967	61	62	77	69	90	116	95	81	99	111	82	100
1968	61	64	77	70	89	117	97	85	100	108	86	100
1969	61	62	77	71	88	118	94	81	100	110	87	100
1970	64	67	78	72	89	118	93	72	100	108	84	100
1971	65	64	77	73	89	117	94	82	100	109	76	100

Source: Government of Canada, Economic Review (Ottawa: Information Canada, April, 1973).

MANUFACTURING INDUSTRIES IN ONTARIO — TABLE B-2

1964 - 1972

COST OF ELECTRICITY AS PERCENTAGE OF "VALUE ADDED"

SIC	Industry	1964	1965	1966	1967	1968	1969	1970	1971	1972
10	Food & Beverage	.901	.944	.911	.914	.912	.911	.797	.963	.95
15	Tobacco Products	.725	.643	.586	.532	.578	.570	.614	.63	.55
16	Rubber & Plastics	1.501	1.397	1.353	1.384	1.411	1.010	1.529	1.549	1.55
17	Leather Products	.769	.788	.777	.805	.823	.850	.861	.837	.82
18	Textiles	1.335	1.414	1.580	1.622	1.577	1.507	1.654	1.830	1.78
23	Knitting Mills	.565	.685	.755	.869	.793	.821	.977	.910	.91
24	Clothing	.371	.364	.363	.392	.378	.382	.374	.381	.36
25	Wood	1.158	1.218	1.208	1.179	1.199	1.134	1.511	1.536	1.39
26	Furniture & Fixtures	.732	.703	.706	.694	.744	.737	.826	.841	.76
27	Paper & Allied	4.284	4.254	4.117	4.088	4.163	3.983	4.835	5.210	5.04
28	Printing & Publishing	.517	.500	.496	.474	.492	.497	.529	.518	.52
29	Primary Metals	3.218	3.132	3.210	3.389	3.446	3.346	3.650	3.570	3.71
30	Metal Fabricating	.854	.838	.843	.884	.928	.916	1.003	.952	.93
31	Machinery	.667	.611	.610	.635	.689	.663	.708	.779	.84
32	Transportation Equip.	.750	.746	.786	.740	.851	.808	1.094	1.005	1.01
33	Electrical Products	.800	.794	.726	.816	.849	.852	.899	.852	.80
35	Non-Metallic Minerals	3.269	3.315	3.435	3.245	3.316	3.220	3.404	3.205	3.26
36	Petroleum & Coal	3.579	3.932	3.918	3.962	3.946	4.732	5.487	4.613	4.42
37	Chemical	2.830	2.883	3.032	2.925	2.915	2.806	3.320	3.322	2.98
39	Miscellaneous Mfg.	.646	.775	.660	.644	.605	.627	.730	.762	.73
	All Manufacturing	1.56	1.55	1.54	1.53	1.59	1.56	1.78	1.74	1.69

Source: Power Market Analysis Department, Ontario Hydro, based on Statistics Canada data.

The estimation is made in three stages. First, the electricity costs of the nine industries in 1972 are inflated for every year onward to 1980 on the basis of the escalation forecasts of Table B-3 (See Table B-4), assuming electricity consumption remains at the 1973 levels.

TABLE B-3

Escalation Forecasts
All Manufacturing Industries*

Year	% Change in Electricity Costs	% Change in Labour Costs
1974	5.4	-
1975	10.0	13.5
1976	22.0	11.5
1977	23.2	9.5
1978	17.0	9.0
1979	13.4	11.0
1980	9.8	11.0

Source: Ontario Hydro, Office of the Chief Economist, January 1976.

Second, annual salaries are projected with the same technique (See Table B-5); the base year in this case is 1974. And finally, to calculate the maximum effect on employment, the added cost each industry incurred in one particular year is divided by its average annual salary plus fringe benefits (fringe benefit costs in the context of this study are assumed to total one quarter of the employers' labour cost).[11]
The results are shown in Table B-6. In terms of the total number of employees discharged, the pulp and paper mills and the chemical industry may have to dismiss the most (1857 and 1076 respectively); but as a percentage of total 1972 employees, the cement (15.3 per cent) and abrasives (14.9 per cent) industries have to make the largest reduction in their respective work forces. Altogether, the group has to reduce its workforce by 8.0 per cent.

The percentages are given in terms of 1972 employment levels in each industry to afford some comparison with published data. At the time of writing, fully comparable data were not available for any more recent year. In terms of 1978 employment one may fairly presume the percentages would be smaller for industries where employeemnt is rising and larger for one where it is falling. However, any increase in employment is somewhat offset by the assumption that the use of electricity in each industry would remain at the 1973 level. Forecasting sales or output for each separate industry to 1978 was beyond the scope of this study. For some, (such as pulp and paper), output in 1975 was erratic, and for others (such as abrasives) the future was uncertain.

Finally the estimates must be qualified. As the reader may have noticed, the escalation forecasts are for all intents and purposes forcasts for all manufacturing industries rather than for individual ones. Inasmuch as all forecasts are *conditional*, and the present study is not meant to describe real events in 1978 (which would be impossible) but to indicate the probable direction and magnitude of the effect of rate increases, this limitation will not invalidate our analysis.

C. ASSUMPTIONS REVISITED

The previous section has studied the maximum employment effect possible under a set of very restrictive assumptions. However, it is inconceivalble that an employer would accommodate a higher price for electricity solely by adjusting labour costs downward and at the same time could maintain the same level of production with fewer workers. More likely he would consider every option he had available, including using less electricity. To this end, empirical results are very telling. The long-run price elasticity of industrial demand for electricity in the United States, as Table C-1 demonstrates, may be elastic.

TABLE C-1

Price Elasticity of Demand
For Electricity in Industry

	Short-Run	Long-Run
Fisher & Kaysen	-0.21	NE
Baxter & Rees	NE	-1.50
Anderson	NE	-1.12
Mount, Chapman and Tyrrell	NE	-1.20
Lyman	(-1.40)	

Note: NE = 'not elastic'

Source: Volume II

That is, an increase in price of 1 per cent would lead to a decrease in the use of electricity of more than 1 per cent. The evidence gathered for Ontario is less impressive. Its magnitude probably varies around -0.6. With this information in mind, let us now relax the assumptions made earlier and analyse how management and labour would react to increased rates for electricity.

1. Summary

Two things will be examined here: elasticity of demand for a firm's product, and its future growth prospect. When the de-

[11]Foust observed in 1967 that "Since the end of World War II wages and salaries have tripled. In the same period employer's costs for employee benefits have increased almost six fold...today employee benefits cost American employers an average of almost 20 per cent of payroll." (Foust, *The Total Approach Concept*, p. 10.) More recently, Levin put the estimate at between one quarter and one third of the employer's labour cost (Levin, *Negotiating Fringe Benefits*). In 1962, a Canadian study found that average outlays for fringe benefits ranged from 18.2 per cent of the payroll in Iron and Steel, and Metal Products and Machinery to 28.9 in Finance and Insurance. Furthermore, it reported that the total outlays for fringe benefits in the United States and Canada followed an essentially similar pattern. (See *Fringe Benefit Costs in Canada*.) Consequently, fringe benefits assumed to equal one quarter of annual salary are adopted here.

TABLE B-4

ESTIMATED ELECTRICITY COSTS*
($'000)

	Actual		Estimated					
	1972	1973	1975	1976	1977	1978	1979	1980
Pulp and Paper Mills	30,074	42,333	49,081	59,879	73,771	86,312	97,878	107,470
Industrial Chemicals	22,485	28,342	32,860	40,089	49,390	57,786	65,529	71,951
Petroleum Refineries	7,037	8,036	9,317	11,367	14,004	16,385	18,581	20,402
Smelting & Refining	9,865	10,728	12,438	15,174	18,694	21,872	24,803	27,234
Iron Foundries	3,730	4,315	5,003	6,104	7,520	8,798	9,977	10,955
Cement	3,591	4,282	4,964	6,056	7,461	8,729	9,899	10,869
Abrasives	5,401	6,358	7,371	8,993	11,079	12,962	14,699	16,140
Lime	358	643	746	910	1,121	1,312	1,488	1,634
Misc. Petroleum & Coal Products	103	134	155	189	233	273	310	340

* at time of writing, December 1975.

TABLE B-5

AVERAGE ANNUAL SALARIES, 1972-78
(in dollars)

	Actual*			Estimated**			
	1972	1973	1974	1975	1976	1977	1978
Pulp and Paper Mills	9,661	10,003	11,358	12,891	14,373	15,738	17,154
Industrial Chemicals	11,354	12,159	13,374	15,179	16,925	18,533	20,201
Petroleum Refineries	13,112	14,265	15,869	18,011	20,082	21,990	23,969
Smelting & Refining	9,835	10,625	11,726	13,309	14,840	16,250	17,713
Iron Foundries	9,030	9,755	10,766	12,219	13,624	14,918	16,261
Cement	10,218	11,054	12,122	12,758	15,340	16,797	18,309
Abrasives	9,156	9,905	10,862	12,328	13,746	15,052	16,407
Lime	8,346	9,029	9,901	11,238	12,530	13,720	14,955
Misc. Petroleum & Coal Products	9,466	10,276	11,432	12,975	14,467	15,841	17,267

* Statistics Canada

** Based on labour rate projections, Office of the Chief Economist, December 1975.

MAXIMUM EMPLOYMENT EFFECT

Table B-6

	1976	1977	1978	Total Loss (1976-78)	As % of 1972 employment
Pulp & Paper Mills	601	706	585	1,892	9.3
Industrial Chemicals	342	401	333	1,076	9.9
Petroleum Refineries	82	96	79	257	9.7
Smelting & Refining	147	173	144	464	4.2
Iron Foundries	65	76	63	204	3.0
Cement	57	67	55	179	15.3
Abrasives	94	111	92	297	14.9
Lime	10	12	10	32	9.0
Misc. Petroleum & Coal Products	2	2	2	6	3.1
Total loss of employment				4,407	
As % of total 1972 employment of the 9 industries					8.0

mand is inelastic, the producer can pass on at least part of his added outlays to his customers without significantly diminishing their demand. In an extreme case where the elasticity is zero, it is theoretically possible to raise the price by exactly the same proportion as costs without losing sales. Our estimate of direct employment effects, as outlined above greatly overstates the potential effect on employment under such circumstances. Demand that is very sensitive to price changes, on the other hand, does not leave the producer with much room to manoeuvre. He has to accept a reduced profit margin, or a lower volume of sales, or a combination of the two.

While both perfect and zero elasticities are theoretically interesting, demand for most commodities probably lies betwen these two extremes. That is to say, the impact of rate increases for electricity is usually shared between producers and their customers.[12]

Unfortunately, price elasticities are not available for the nine industries under study, and we have to rely on other indicators to throw some light on how increases in the cost of electricity would be shared between producers and consumers. Profitability ratios, which are used for this, are a function of a host of variables, including price elasticity and managerial skills. One could expect an industry enjoying high returns to find it comparatively easy to overcome a profit squeeze from rate increases and still maintain reasonable returns.

Moreover, an industry with a history or relatively stable profits could presumably look back on past experience and come up with some notion of the linkages between profits, price, and sales. Then it could decide with some confidence what percentage of electricity cost increases to pass on to customers in the form of a higher product price. In contrast, industries with fluctuating profits lack this information. The fluctuation itself may reflect the stochastic characteristic in a number of important variables, but it is difficult for producers of these industries to separate the influence of price changes from that of other variables. It is conceivable that a slight price increase might intensify the amplitude of fluctuation and create a higher degree of uncertainty. That management is in general risk-adverse leads us to the proposition that industries under this circumstance are slow to adjust their prices upward. In other words, the burden of rate increases would be borne mainly by the producers, at least at the outset.

It should be pointed out before we proceed to examine the tables that the financial data collected for various industry groups relate to Canada as a whole. However, since Ontario ranks as Canada's chief industrial centre, the pattern of its financial statistics closely resembles that of the whole country. A more serious problem, though, is its aggregation. Since each individual industry group comprises a number of industries, a group average may not be representative of some particular industry at all. Future improvement upon the present study must therefore include refining this datum. Table C-2 records the profitability ratios of five industry groups, to which the nine electrically intensive industries belong. As a frame of reference, industrial average profitability is also presented. The table shows the manufacturing sector arrived at a peak ratio of returns in 1964, but was faced with a deteriorating market from then on, reaching a low point in 1970; conditions in the four years to 1974, however, have improved greatly. With this information as a point of departure, let us look at the five groups one by one.

To start with, the pulp and allied industries and forestry have an erractic pattern of profitability over time. Until 1967, the ratio was higher than the industrial average; but since then, except for 1974, it has fared badly. Above all, it fluctuated widely, between 2 per cent and 16.2 per cent. Recall, though, that one can attribute changes in the profitability ratio to two sources: profits and assets. A fluctuating ratio may reflect no more than erratic behaviour of the variable assets. It is necessary, therefore, to inspect the actual profit statistics. Again the data in Table C-3 lend weight to the contention that the profits of this group vary unpredictably.

Next let us look at the primary metal industries. It is obvious that this group closely followed the trend set by all manufacturing industries, except that the ratio was consistently lower. At the same time, the original profit data, 1973 and 1974 excepted, reveal a relatively stable pattern throughout the period. It is interesting to note the similarity between this group and non-metallic mineral-products industries. The latter likewise performed less satisfactorily than the rest of the sector. Only in four years did their profitability ratio rise above the industrial average. Nevertheless, this group's returns on capital were not so very well behaved, but moved between 4.2 and 13.2 per cent. The statistics in Table C-3 bear this point out.

Of all five groups, the petroleum and coal-products industries performed most impressively. Their returns on capital continued to grow throughout the entire period, regardless of the state of the economy. Specifically, profits rose from $177 million in 1962 to $1422 million in 1974, whereas total assets increased from $2950 million to $9753 million during the same period. Thus the manufacturers of these products have two major courses of action to choose between. They can either shift a large share of rate increases for electricity to their customers without affecting sales, or else accept a lower level of profits. A profit-maximizing firm would probably adjust itself through a higher price whenever possible. Finally, the chemical products industries reported an above-average profitability ratio. Nevertheless, this group did show a cyclical pattern similar to the sector as a whole.

To summarize, in view of the foregoing discussion, we can rank the five groups in terms of profit stability as follows:

1. Petroleum and Coal-Products Industries
2. Chemical and Chemical-Products Industries
3. Primary Metal Industries
4. Non-Metallic Mineral-Products Industries, and
5. Pulp and Allied Industries and Forestry

It must be reiterated that the price elasticity of a company's product differs from its profitability ratio; as a means of assessing how much of the burden of rate increases the producer can pass on price elasticity remains the best indicator. However, its unavailability entails using profitability ratios in its place.

Moreover, business managers have often no measurements of demand elasticity. Although they have a 'feel' for the elasticity of their own product, what weighs most with them when they decide to pass on a cost increase to their customers is the need to ensure stable profits, unless some quite different corporate objective is overriding.[13] Our evidence indicates a more uncertain market for the pulp and paper products than for others, and it

[12]For a more detailed exposition of price elasticity and the share of burden, see Appendix II.

[13]See Oxenfeldt, *Industrial Pricing and Market Practices* (New York, 1951), and the Prices and Incomes Commission, *The Short Run Impact of Foreign Inflation on Canadian Prices*.

Profitability Ratios and Profit Margins of Manufacturing Industries and Selected Industry Groups, 1962-1974

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
	(Percent)												
Total Manufacturing Industries													
Profit/Assets	8.7	9.6	10.3	10.1	9.5	7.8	8.3	8.8	6.4	7.9	9.2	12.1	13.7
Profit/Sales	7.4	8.0	8.4	8.0	7.5	6.3	6.6	6.9	5.2	6.1	6.8	8.1	8.8
Pulp and Allied Industries, and Forestry													
Profit/Assets	11.3	11.7	13.1	11.0	10.5	6.0	5.2	7.0	3.6	2.0	3.0	8.8	16.2
Profit/Sales	14.2	14.0	16.0	13.9	12.6	8.0	6.8	8.7	4.9	2.8	3.7	9.5	14.8
Primary Metal Industries													
Profit/Assets	7.2	7.5	9.4	10.8	9.4	6.2	6.9	6.3	6.7	6.2	6.4	8.8	12.7
Profit/Sales	10.7	10.9	12.7	14.1	11.9	8.8	9.5	8.2	8.4	8.0	8.0	9.5	12.2
Non-metallic Mineral Products Industries													
Profit/Assets	7.4	7.2	10.6	10.7	11.5	5.6	6.3	7.5	4.2	8.2	8.9	12.1	13.2
Profit/Sales	8.2	7.7	10.7	10.8	12.8	6.4	6.7	7.5	5.1	8.1	8.2	9.9	10.4
Petroleum and Coal Products Industries													
Profit/Assets	6.0	5.7	6.2	6.5	7.4	7.5	7.7	7.2	7.9	9.4	10.0	13.8	17.8
Profit/Sales	7.2	7.2	7.7	8.0	9.0	9.3	9.4	8.7	9.5	10.8	11.4	14.0	15.5
Chemical and Chemical Products Industries													
Profit/Assets	10.0	12.1	13.4	13.3	12.7	10.4	11.2	11.3	9.6	10.0	11.6	13.9	19.7
Profit/Sales	8.9	9.9	10.8	11.0	10.2	8.9	9.6	9.0	7.8	8.0	8.9	9.8	12.6

Source: Calculated from Table C-3

Financial Statistics

(in million dollars)

	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974
Manufacturing													
Profit before tax	2082	2430	2801	2994	3079	2776	3135	3499	2706	3516	4346	6163	8150
Total Assets	23787	25183	26980	29532	32310	35423	37339	39480	42109	44108	46801	50853	59102
Sales	27988	30062	32959	37142	41021	43784	47100	50642	51875	57509	63208	75762	92256
Pulp and Allied Industries, and Forestry													
Profit before tax	370	395	480	451	478	304	278	385	217	129	190	578	1187
Total Assets	3261	3355	3651	4090	4528	5044	5262	5489	6019	6166	6325	6512	7305
Sales	2509	2807	2998	3232	3781	3786	4040	4405	4359	4476	5052	6067	7967
Primary Metals Industries													
Profit before tax	222	237	316	384	336	259	303	284	314	309	323	465	766
Total Assets	3069	3145	3331	3552	3565	4142	4348	4483	4657	4907	4946	5239	6004
Sales	2065	2174	2486	2723	2814	2911	3173	3456	3718	3821	4011	4883	6232
Non-metallic Mineral Products Industries													
Profit before tax	68	68	105	114	142	73	85	112	67	136	156	235	295
Total Assets	907	944	989	1060	1229	1286	1345	1485	1580	1646	1737	1931	2220
Sales	825	872	979	1052	1104	1130	1266	1493	1298	1666	1886	2356	2812
Petroleum and Coal Products Industries													
Profit before tax	177	187	214	239	291	317	350	343	397	501	585	909	1422
Total Assets	2450	3256	3410	3633	3885	4204	4510	4699	4986	5305	5943	6549	7953
Sales	2432	2565	2750	2952	3224	3415	3688	3909	4151	4636	5119	6465	9143
Chemical and Chemical Products Industries													
Profit before tax	149	177	205	232	242	217	259	270	243	269	326	423	710
Total Assets	1489	1454	1524	1738	1899	2069	2296	2380	2521	2667	2805	3040	3592
Sales	1656	1772	1887	2096	2364	2429	2689	2983	3096	3347	3635	4296	5628

Source: Statistics Canada, Industrial Corporations, Financial Statistics, various issues.

follows from our proposition that industry will find it harder to shift the burden of rate increases to its costomers than (say) the petroleum industry.

Pulp and paper, though, is something of a special case. The background study on it therefore used year-by-year forecasts of selling price, to take account of the unstable profits.

Apart from the elasticity of demand, future demand outlook will also affect employment. In any of the nine industries, substantial increases in the demand for a product could more than offset the ill effects on employment of higher prices for electricity, so that employment rose rather than fell.

To predict future demand is not an easy task, especially when one is making a forecast for 1978 based on information available up to 1973 or 1974. Nevertheless, profit margins provided in Table C-2, and past annual growth rates presented in Table C-4, do shed some light on the prospect of industry. Most of the industries enjoyed good market conditions during the past several years and earned respectable profits. The Canadian economy, however, has not performed well since then. The change in the domestic economic environment is further complicated by the world recession of 1974-75 which has severely affected industries dependent on exports (e.g., metal and pulp and paper products). Moreover, as long as high interest rates in Canada and large-scale borrowing abroad keeps the value of the Canadian dollar high, industries exporting price-elastic products will lose export sales. A growth rate of 5.1 per cent for the paper industries, for example, is unlikely to be maintained. The Economic Council of Canada in fact predicts growth rates for that industry group of 4.4 per cent for 1973-1977 and 4.8 per cent for 1977-1982.

TABLE C-4

Real Domestic Product, Annual Growth Rates of Selected Industry Groups, Selected Period

	1935 -1973	1947 -1973	1961 -1973	1966 -1973	1970 -1973
Manufacturing	5.3	5.3	6.0	4.9	7.0
Paper and Allied Industries	4.7	3.5	4.0	4.0	5.1
Petroleum and Coal Products Ind	7.6	7.2	5.5	6.9	10.5
Chemical and Chemical Products Industries	7.5	7.8	7.5	6.1	6.9
Primary Metal Industries	-	-	5.2	3.9	3.8
Non-Metallic Mineral Products Industries	7.3	6.0	4.6	4.6	10.0

Source: Statistics Canda, Index of Real Domestic Product, 1974 Supplement.

The petroleum and chemical industries, on the other hand, will continue to have an above-average growth in manufacturing on the basis of past performance. The forecasts of the Economic Council of Canada predict 5.4 per cent and 5.9 per cent for the chemical industries for the same two periods mentioned above.[14]

While the primary metal industries show the lowest rate of growth, and do not seem to improve much, the non-metallic mineral industries made a tremendous gain in the past few years.[15] However, the situation is not likely to continue. A much lower rate is expected.

2. Conservation

As electricity becomes more expensive, one of the options open to management is to conserve it. An Ontario Hydro study found that "industry in general has no conservation of electricity programs, as they rely wholly on the market system to adjust for supply and demand".[16] As a first step towards this, management can take these actions:

2. Turning off machines and devices when not needed;

2. Purchasing more efficient equipment; and

3. Reducing the amount of scrap during production.

After these and similar procedures have been followed, further power savings require introducing process redesign and other innovations.

The same study reports that the pulp and paper mills, the primary metals industry, the petroleum and coal-products industries, the chemical industries, and the non-metallic mineral industries possess the greatest potential for conservation, representing over 90 per cent of the total estimated potential (See Table C-5). Altogether, total savings are estimated at about 4.2 per cent of the 1972 consumption in Ontario.[18] In order to incorporate this information into our estimate of employment effect, each industry's savings (in dollars), presented in Table C-6, are subtracted from the 1972 electricity costs; Table C-7 shows what electricity costs would have been in 1972 if conservation programs were adopted. The employment impact is now re-estimated (See Table C-8).

TABLE C-6

Estimated Conservation of Electricity (based on 1972 loads)

	Electricity Saved (kWh x 10^6)	Decrease In Cost ($'000)	% Decrease In Cost
Pulp and Paper Mills	188	1,316	4.4

[14]Economic Council of Canada, *Economic Targets and Social Indicators*, p. 178 and pp. 186-187, 1974.

[15]Note that the demand for abrasives products has become stagnant so the above projections do not apply to this industry. See Ontario Hydro, *Energy Use in the Abrasives Industry in Ontario*

[16]Ontario Hydro, *Utilization and Conservation of Electricity in Industry in Ontario*, p. 3. This section draws heavily upon the materials contained in the study. An exception is the abrasives industry where electricity costs account for 20 per cent of the value added. See Ontario Hydro, *Energy Use in the Abrasives Industry in Ontario*.

[18]Statements in 1976 by the International Energy Agency concerning Canada's poor performance in energy conservation, have particularly singled out the pulp and paper industry and the petroleum industry. Consequently, the conservation potentials estimated here may be understated.

Estimated Conservation of Electricity by Application - Ontario Manufacturing Industries. (Use 1972 as base).

SIC	Industry Group	Max. Possible Saving in kWh x 10^6				% of Total
		Motor	Process	Light	Total	
10	Food and Bev.	20	4.4	4.2	28.6	2.7
15	Tobacco Prod.	-	-	-	-	-
16	Rubber & Plastics	6	4.0	-	10.0	1.0
17	Leather	-	-	-	-	-
18	Textiles	14	2.0	3.0	19.0	1.8
23	Knitting Mills	-	-	-	-	-
24	Clothing Ind.	-	-	-	-	-
25	Wood Ind.	1	-	-	1.0	0.1
26	Furniture & Fixt.	-	-	-	-	-
27	Pulp and Paper	185	6.0	3.0	194.0	18.6
28	Printing & Publish.	-	-	-	-	-
29	Primary Metals	119	106.0	2.0	227.0	21.8
30	Metal Fabric	2	5.0	-	7.0	0.7
31	Machinery Ind.	2	3.0	-	5.0	0.5
32	Transport'n. Equip.	12	15.0	10.0	37.0	3.6
33	Electrical Prod.	2	8.0	-	10.0	1.0
35	Non Metallic Min.	24	80.0	3.0	107.0	10.3
36	Petroleum & Coal	-	-	5.0	205.0	19.3
37	Chemicals	155	34.0	2.0	191.0	18.3
39	Misc. Manufacturing	-	-	-	-	-
	TOTAL MANUFACTURING	742	267.2	32.2	1041.6	100.0
	Conservation as Per cent of Application load	4.1	7.5	1.2	4.2	
	Percent Distribution of Conservation	71.2	25.6	3.2	100.0	

Source: Ontario Hydro, Utilization and Conservation of Electricity in Industry in Ontario, P. 44.

EMPLOYMENT EFFECT RE-ESTIMATED

TABLE C-8

Industry	1976	1977	1978	Total Loss of each industry (over three years)	As % of 1972 employment
Pulp and Paper Mills	573	675	559	1,807	8.9
Industrial Chemicals	323	380	315	1,018	9.3
Petroleum Refineries	64	75	62	201	7.6
Smelting & Refining	143	168	139	450	4.0
Iron Foundries	56	66	54	176	2.6
Cement	56	65	54	175	14.9
Abrasives	85	100	83	268	13.5
Lime	10	12	10	32	9.0
Misc. Petroleum & Coal Products	2	2	2	6	3.1
Total loss of employment				4,133	
Percent of total employees employed by the industries					7.5

Industrial Chemicals	175	1,225	5.4
Petroleum Refineries	205	1,558	22.1
Smelting & Refining	45	315	3.2
Iron Foundries	42	512	13.7
Cement	10	79	2.2
Abrasives	85	536	9.9
Lime	0	0	0
Misc. Petroleum & Coal Products	0	0	0

3. Downward Wage Rigidity

For the sake of exposition, wage rates for all nine industries were assumed in Section B to increase by the same percentage as the manufacturing-sector in general. One implication of this is that the workers in the industries under study were not concerned with the possibility of unemployment when they negotiated new contracts with their employers. They demanded and received a wage settlement which would maintain the existing relative wage structure. However, a more realistic approach requires a major modification of this assumption. Classical economic theory assumes flexible wages and prices, so that when the demand for labour declines, wages fall to maintain full employment in the labour market.

In a time of rapid inflation, it is not necessary for workers of an affected industry to lower their money wages to retain employment. If they simply maintain a rate of wage increases which is less than that of other industries, the potential impact of higher power rates on employment will be substantially lessened. The degree of sacrifice each worker has to make definitely varies, depending on how vulnerable his industry is to rate increase. As a first approximation, workers of the cement and abrasives industries will be required to make the greatest sacrifice because they are faced with the highest possibility of unemployment. Workers with skills that are easily transferrable, such as secretarial skills, are unlikely to moderate their wage demands; on the other hand, those with skills that are specialized and particular to energy-intensive industries may be expected to lower their demands.

It is worthwhile to mention in passing that the wage and price controls that the Canadian government recently imposed have had a disrupting influence on this type of adjustment mechanism. Presumably the 10-per cent ceiling, which is below the going rate of inflation, will be reached by workers of both inside and outside the manufacturing sector. When this occurs, the relative wage structure of industry will remain frozen for the next couple of years. Then we have a typical case of downward wage rigidity arising from institutional rigidity. Over a longer time horizon, when the government manages to bring down the rate of inflation the situation is likely to change. At that time market forces will again emerge as a powerful vehicle of adjustment.

ELECTRICITY COSTS RE-ESTIMATED
1973-1980

TABLE C-7

Industry	1973	1974	1975	1976	1977	1978	1979	1980
			(in $'000)					
Pulp and Paper Mills	40,470	42,655	46,921	57,244	70,525	82,514	93,571	102,741
Industrial Chemicals	26,812	28,260	31,086	37,925	46,724	54,667	61,992	68,067
Petroleum Refineries	6,260	6,598	7,258	8,855	10,909	12,764	14,474	15,892
Smelting & Refining	10,385	10,946	12,040	14,689	18,097	21,173	24,010	26,363
Iron Foundries	3,724	3,925	4,318	5,268	6,490	7,593	8,610	9,454
Cement	4,188	4,414	4,856	5,924	7,298	8,539	9,683	10,632
Abrasives	5,729	6,038	6,642	8,103	9,983	11,680	13,745	14,543
Lime	643	678	746	910	1,121	1,312	1,488	1,634
Misc. Petroleum & Coal Products	134	141	155	189	233	273	310	340

How far workers are willing to accept a lower level of real income is an empirical question. However, it must be recognized that price adjustment is inherent in, and fundamental to, our market-oriented economic system. No matter how powerful a union is, it must come to place job security at top priority and forgo huge wage increases when the workers' employment is at stake. In short, the workers of the affected industry may absorb the rate increases partly in the form of lower growth in wage rates rather than in the form of unemployment alone.

4. Factor Substitutions

It has been pointed out in Section A that an increase in the price of electricity, other things being equal, will disturb the marginal condition and necessitate a readjustment process in which other relatively cheaper inputs are substituted for electric power until equilibrium is re-established. Two input substitutes are of special interest here, labour and capital. In theory, if labour and electricity are perfect substitutes, the price cross-effect is definitely positive: that is to say, the total employment of labour increases. In practice, however, labour can only replace electricity within certain limits, the extent of which awaits empirical estimation.

By the same token, manufacturers can use more capital and less electric power within certain limits. With time-of-day pricing, capital spent on storage facilities for work in progress will permit shifting electrically intensive processes to weekends and the night-time, and so save generating-capacity. In reacting to changes in the price of electricity, capital can be used to replace older, energy-inefficient machinery and equipment with newer ones incorporating energy-saving technology. But this alternative is not always open, for the simple reason that capital and electric energy (and energy in general) tend to be highly complementary. When more capital equipment is employed (as it is in the historical trend, where capital is substituted for labour), larger volumes of electricity are consumed. More interesting are the technological improvements, and expansion of the service sector, that result in reduced energy requirements. Figure C-2 shows a long-term decline to 1970 in the amount of energy used to produce a dollar of the Gross National Product.[19]
The trend is more impressive when one recalls the continuous decrease of energy prices (relative to other prices) before 1970. By usual reasoning, a lower fuel price should induce substitution of energy for other inputs. But in this case introduction of energy-saving technology in manufacturing has obviously more than offset the price effect, causing the ratio of energy use to GNP to fall. And if past experience is any guide, the forces of technological change in response to rapidly increasing energy prices since 1973 (including electricity rates) are quite likely to produce an acceleration in energy savings in manufacturing. A report for the United States suggests that energy use per unit of output will decline at an average rate of 2.0 per cent from 1967 to 1980.[20]
Increases in output and energy costs have nevertheless increased energy bills for industry. Moreover, with many products substitution of electricity for other kinds of energy has increased its percentage of value added.

Summing up, while the substitution of labour for electricity moderates the adverse effect of rate increases on employment, the substitution of capital and energy-saving technology further mitigates the potential impact.

5. Fuel Substitutions

An increase in the price of electricity, compared to other kinds of energy will lead to the substitution of alternative fuels for electricity as well. It is important to keep in mind that the fuel-substitution process is a long-run adjustment, the reason being that capital equipment is usually fuel-specific. A switch from one source of energy to another involves installing new and expensive capital equipment. A specific example is the iron-foundry industry. When an iron foundry decides to use more electricity and less coke, it must replace cupolas with induction furnaces, which cost twice as much.[21] Therefore it does not pay a firm to change the energy mix abruptly. The general practice is to let the existing machine depreciate in the future and buy a new one which uses the preferred fuel.

TABLE C-9

Industrial Electricity Use As A
Percentage of Total Energy Consumption
1969-1972

	1969	1970	1971	1972
	(Per Cent)			
Abrasives	93.5	93.9	94.0	94.6
Pulp and Paper Mills	47.1	48.9	49.4	48.5
Industrial Chemicals	44.2	48.9	48.0	39.4
Smelting & Refining	30.7	33.6	30.2	33.5
Cement	28.6	28.0	28.8	27.3
Lime	8.9	8.0	9.0	8.5
Petroleum Refineries	79.8	79.1	80.6	78.9
Iron Foundries	52.6	59.7	59.7	63.2
Other Petroleum Industries	15.7	17.1	18.8	19.1
Ontario Mfg. Industry Avg.	43.5	44.9	44.5	44.2

Source: Calculated from Ontario Hydro, Trends in Energy Use Within Ontario Manufacturing Industries, 1964-1972.

[19]As will be seen shortly, the intensity of electricity has been increasing for most of the industries under study. We suspect that the decreasing relative cost of electric power (until 1970) is probably responsible for this phenomenon. As power rates are rising rapidly, the trend should change.
[20]See Reference #6.
[21]See *Utilization and Conservation*, pp. 38-39.

To put the energy input into its proper perspective, Table C-9 tabulates electricity use as a proportion of total energy consumption in the selected industries. It is evident that even industries which are relatively electrically intensive not depend on electricity alone; and therefore its price alone is not likely to make or break them. True, the abrasives industry spends some 94 per cent of its energy outlay on electricity; but then the outlay of the lime manufacturers on electricity is exceptionally low (8.51 per cent or so).

Except for smelting and refining, all the industries that are chosen for analysis have been using more electricity as a percentage of value added over time (Table E-1). The trend is noteworthy in the light of the long-term decline in the amount of energy used to manufacture a unit of product,[22]
but there are two basic reasons for it. To take an illustration from the recent past, because of the technical efficiency and convenience of the electric motor as compared with the cumbrous apparatus of belts and shafting required to operate machinery from steam engine or a waterwheel, electricity is modern industry's pre-eminent form of energy used for motive power. Moreover, to the user at least electric power is clean energy. At a time when public concern for environmental deterioration is widespread, and legislation has been enacted to control emission of pollutants, the substitution of electricity for polluting fuels is only a logical development. It also explains the dwindling role of coal as a source of energy.

Other things being equal, a rate increase leads to a substitution of alternative fuels for electricity. The impact of electricity cost increases will be lessened insofar as this adjustment occurs. However, there is no indication that any of the competing fuels will remain at a constant price. Table C-10 presents the cost escalation of the chief sources of energy used by industry. The only fuel whose price is expected to rise at a comparatively lower rate than electric power in the second half of 1970s is coal. But it is unlikely that industry will return to relying on coal as the main source of energy, because of the problems of pollution; in the much longer term, coal gasification may, of course, offer an alternative.

Given that oil and natural gas are forecast to have price increases comparable to power rate increases, and that coal is not a viable alternative for the short run, other forms of energy will not be substituted for electricity to any significant extent. We can derive two implications from this. First, conservation of electric energy will take on a more important role as producers find it difficult to substitute a cheaper fuel, and the, search for energy-saving technology will become a higher priority. Second, if the amount of electric energy per unit of input rose, it could mean a less efficient fuel (say coal) is being replaced. The additional cost of electricity incurred in this way should be offset by saving not only the costs that would be incurred if coal were used, but also those of pollution abatement programs.

To sum up, the estimates made in Section B exaggerate the potential impact of rate increases on employment over the next three years. Relaxation of these assumptions means that all the industries, without exception, will have a lower level of employment loss than that maximum estimated in Table B-6, Appendix D; and in order to derive the 'most probable' effect, the maximum employment effect is revised in the following manner and the results presented in Table C-11.[23]
As each restrictive assumption is relaxed in turn, the analysis estimates how many jobs would be saved compared to the maximum direct effect on unemployment.

a. Conservation

The method has already been described in detail in Section C(2).

b. Selling-Price Adjustment

The calculation here is based on the conclusions drawn in C(1). Since the manufacturers of petroleum products are in a much better position to shift the burden, they are assumed to pass on a large share of their increased electricity costs to their customers in the form of higher product prices without adverse effects on sales. By the same token, industries faced with uncertain demands have considerable difficulty passing on the added costs. Specifically, we apply this schedule based on profitability and recent market trends (discussed above and elsewhere):

c. Factor Substitutions

Since three industries - industrial chemicals and the two petroluem industries - are assumed to pass along a large share of their increased costs, the incentives to substitute other factors for electricity are fewer and less obvious. That is to say, we expect this adjustment to have a negligible effect on those estimates. By contrast, factor substitutions will play a larger role in the other industries.[24] Assuming substitution to increase employment opportunities by a token 0.75 per cent of the respective employment levels over the three-year period, we obtain the results in the accompanying table. That is, substituting lower-cost factors for electricity partly mitigates the increases in costs; and since our analysis uses jobs as the measuring-unit for impact, some of the effect on employment is reduced further.

Industry	Number of Jobs
Smelting & Refining	84
Iron Foundries	50
Cement	9
Abrasives	15
Lime	3

d. Wage Adjustment

It is argued above that because the wage ceiling may impede the working of the labour market system, it is difficult to determine how important this adjustment vehicle will be in the years ahead. However that may be, it is possible to hypothesize that faced with an unfavourable job market in their own industry, and a high rate of general unemployment, workers of the abrasives

[22]Conference Board, *Energy Consumption in Manufacturing*, pp. 2-3.

[23]An internal study has been done on the pulp and paper mills in Ontario. The conclusions derived from these are essentially similar to ours even though the approach itself differs slightly For the purpose of cross reference, the estimate made in that study is incorporated into our "most probable" estimate. See *The Impact of Rate Increases on the Pulp and Paper Industry, 1976-1978*

[24]Note that factor substitution is not expected to mitigate the impact of rate increases on employment in the pulp and paper industry The reason is that substitution of capital for labour will persist strongly into the future even though the rate of substitution per se may actually have slowed down. *Ibid.*

TABLE C-10

Energy Price Escalation

YEAR	ELECTRICITY Index	ELECTRICITY %	NATURAL GAS Index	NATURAL GAS %	OIL Index	OIL %	COAL Index	COAL %
1975	100.0		100.0		100.0		100.0	
1976	124.1	24.1	118.0	18.0	116.0	16.0	113.0	13.0
1977	152.9	23.2	139.2	18.0	134.6	16.0	127.7	13.0
1978	178.9	17.0	164.3	18.0	156.1	16.0	144.3	13.0
1979	202.9	13.4	193.9	18.0	181.1	16.0	163.0	13.0
1980	222.8	9.8	228.7	18.0	210.0	16.0	184.2	13.0

Source: Delphi Fuel Forecast, amended by
Office of Chief Economist, December 1975.

TABLE C-11

LOSS OF EMPLOYMENT OPPORTUNITIES IN VARIOUS INDUSTRIES, 1976-1978

Employment loss after relaxing:	Pulp and Paper Mills*	Industrial Chemicals	Petroleum Refineries	Smelting and Refining	Iron Foundries	Cement	Abrasives	Lime	Misc. Petroleum & Coal Products
Maximum employment effect (before relaxing	1,857	1,076	257	464	204	179	297	32	6
a. Conservation	1,774	1,018	201	450	176	175	268	32	6
b. Selling price adjustment	757	279	35	170	66	120	268	22	1
c. Factor substitution	757	279	35	86	16	111	253	19	1
d. Wage adjustment	757	279	35	83	16	90	200	19	1
e. Employment	1210	10	-98	578	-7	-32	178	15	-6

* Results obtained from the Impact on Pulp and Paper Background study.

** This factor turns out to have a net aggravating rather than mitigating effect of rate increases. Hence, the cushioning factors are a to d inclusive.

Industry	Proportion of Additional Electricity Costs Borne By Customers	Jobs Retained by Raising Product Prices
Pulp and Paper Mills	**	1,017
Industrial Chemicals	70%	739
Petroleum Refineries	80%	166
Smelting and Refining	60%	280
Iron Foundries	60%	110
Cement	30%	55
Abrasives	0	0
Lime	30%	10
Misc Petroleum and Coal Products	80%	5

and cement industries would be more willing to accept a lower rate.

e. Employment Trend

Future employment opportunities are extrapolated in the accompanying table.

The projections show a significant decrease of employment opportunities in both the pulp and paper mills and the smelting and refining-industry. Increases in the power rates therefore serve to aggravate the declining trend. Note that the background study on pulp and paper approached this subject differently.[25]
It used forecasts of productivity trends to estimate future labour requirements independent of increased rates for electricity. This approach could not be used here, because it would have entailed studying each industry in depth. In contrast, employment growth in the other industries will cushion part of the actual impact.

Thus the net decline in employment from increased labour productivity and similar external factors will aggravate the direct employment effects on the nine industries *taken as a whole*. But this factor would mitigate those effects in any particular industry where the underlying trend was to increase employment. Even though in seven of the nine industries it would lower the impact by 580 jobs, this study has opted for more cautious approach and excluded it as a mitigating factor, on the ground that it cannot be considered a cushion in all nine industries together.

After all these adjustments have been made, the most probable negative direct employment impact is estimated to be 1480 jobs, which equals 2.7 per cent of the 1972 total employment level in these industries.

D. EFECTS OF CHANGES IN RATE STRUCTURES

The foregoing analysis has been based on the presumption that the 1975 rate structure will remain in effect until 1978. Let us call this Scenario A, in which rates of all large users increase by a factor of 1.78 between 1975 and 1978 with no change in the rate structure. Now consider another scenario, B, which embodies a new rate structure with three general features:

1. Change the system demand energy revenue split from approximately 65:35 to 35:65;
2. For three newly defined user categories (less than 50 kilowatts, 50-3000 kilowatts, more than 3000 kilowatts) set standard demand and energy rates throughout Ontario, and
3. Use a customer charge to price fixed costs (ones that do not vary with output), and to enable municipal utilities to meet their individual revenue requirements.

The new rate schedule was hypothesized to take the form shown in the accompanying table.[26]

[25] Ibid.

[26] This figure was used in the case studies. It has been revised downward to 1.8 in January 1976.

	Employment Growth			No of jobs created(+)/lost(-)
	Actual		Predicted	
	1963-73	1968-73	1973-78	1975-78
	(in percent)			
Pulp and Paper Mills*				(-453)
Industrial Chemicals	1.48	-0.04	0.72	+269
Petroleum Refineries	1.40	1.87	1.60	+133
Smelting and Refining	0.23	-4.42	-2.10	-495
Iron Foundries	1.97	-1.78	0.10	+ 23
Cement	1.85	4.06	2.96	+122
Abrasives	0.45	0.22	0.34	+ 22
Lime	-0.3	0.96	0.33	+ 4
Misc. Petroleum and Coal Products	-4.6	6.8	1.1	7

Note: Annual growth rate for 1973-8 = 1/2 of annual growth rate for 1963-73 + 1/2 of annual growth rate for 1968-73.

Source: Calculated from publications of Statistics Canada.

Scenario B rates for retail customers are:

	1978		
	0-50 kW	50-3000 kW	more than 3,000 kW
$c.c	$4/mo.	$400/mo.	$3,000/mo.
¢/kWh	2.77¢/kWh	1.81¢/kWh	1.68¢/kWh
$/kW	0	$3.42/kW	$4.31/kW

The rates based on marginal costs that were developed after study differ somewhat from those shown here. Customer charges tend to be lower, and the differential between the peak and off-peak energy rates is considerably greater. The demand-energy split remains the same. Thus the main use of this analysis is to show the effects of flattening the rate structure and the general tendency of the effects of basing rates on marginal costs. The conditions are:

1. Average rates in the 0-50 kilowatt and 50-3000 kilowatt user categories increase by a factor of 1.9 between 1975 and 1978.
2. Average (large-user) rates in the over-3000-kW category double between 1975 and 1978.
3. Peak-versus-off-peak rates are introduced for large users, non-coincident peak demand being measured between 700 and 2300 hours on weekdays, with differential of about .15 cents per kWh between peak and off-peak energy charge.

Of special interest to our discussions here is the 3000 kilowatt category. Since the nine industries under study consume a large amount of power, it is only natural to inquire what effects the change in the rate structure would have on their consumption patterns. Presumably, industries that can adapt themselves to new rate schemes may gain from the effected change, while others that cannot adapt may lose and pay a higher price. The purpose of this section, then, is to try to identify the category each industry falls into.

1. Foundations of Scenario B

As can be seen from the description set out earlier, Scenario B differs from Scenario A in two important areas:

1. More emphasis is placed on the energy charge component, reflecting the increasing fuel cost to Ontario Hydro from the increased share of fossil-fuel generation and escalation in fuel prices; and
2. Along with the new customer charge, the energy charge is differentiated depending on time of use, off-peak rates coming into effect on weekends, holidays, and between 2300 and 700 hours when demand charge is not applied. There are no rate blocks.

Since the cost of generating electric power varies with time of use, peak-load pricing is part and parcel of marginal-cost pricing. The high cost of supplying electricity at times of system peak is built into the rate scheme through a differential of 0.15 cents a kilowatt-hour plus demand charge.

In short, Scenario B is the outcome of applying marginal-cost pricing to situations that could exist in the real world. In view of its substantial differences from Scenario A, it is of special interest to study the impacts of such a new structure on the consumption of various industrial customers.

2. Impacts of Scenario B

a. Cost and benefit

Peak-load pricing creates price incentives to relocate demand for electricity away from peak periods. However, the price advantage of shifting load off peak is available only as far as net cost savings occur. In other words, there are certain costs associated with shifting operation to off-peak hours; when these are substantial, it may not pay firm to re-schedule its operation. One of these costs, and the main one, is added plant investment required. There are two reasons for that. First, because the on-peak period is every weekday from 700 to 2300 hours (i.e. 16 hours out of 24), more plant production capacity and/or storage is need to shift electricity intensive production to the off-peak hours. Second, if a firm is already operating on a three-shift basis, and production is evenly distributed among them, then it probably would not shift production from day to night shift unless capacity increased at the same time. Another entry to the cost side would be labour costs, which would also be expected to increase because of the greater cost of labour with night-shift differentials.

The foregoing paragraph lists the main costs of off-peak operation. Even if the costs are prohibitively high and a three-shift plant takes no step to reshuffle its operation, that does not mean that the plant has to bear the full burden of (higher) on-peak rates. For one thing, it would receive a discount on its usual night-time consumption, and that would partly offset (perhaps even wholly offset) the increased costs of the power it used on peak. The three-shift plant could also re-schedule the electrically intensive parts of its operation to nights and/or weekends, and thus mitigate the effects of Scenario B further. At a time of slack market demand, the off-peak provision comes into play again. The manufacturer could keep production costs low by cutting back day-time operation but leaving the night-time (off-peak) operation unaltered.

The cost consideration aside, the nature of the manufacturing process needs to be considered also. For an industry whose process continues for a long period of time, the price advantage offered by the off-peak operation appears far less attractive. A case in point is abrasive materials. In that industry the process lasts more than fifteen hours from start to finish, making it all but impossible to schedule the furnace to use only off-peak hours on a continuous basis.[27] The appropriate strategy for that industry to adopt, then, is to re-schedule production around the period between 11:00 p.m. and 7:00 a.m., and to make the best use of weekends. Those abrasive companies that already work weekends will benefit without much change.

b. Qualitative assessment

Most of these industrial establishments operate on a continuous basis. They reduce the number of shifts merely in response to lower demand. An exception to the rule is the iron foundries, most of which operate on one shift.[28] The one-shift plant is bound to benefit from the new rates if the entire production could be relocated to off-peak hours. One-shift plants which do

[27] *Energy Use in the Abrasives Industry in Ontario*, p. 16
[28] *Energy Use in the Iron Foundry Industry in Ontario*, p. 4.

not enjoy this kind of flexibility, on the other hand, would incur higher electricity costs than otherwise.

In view of the foregoing discussion, an industry with chronic overcapacity could seize the opportunity provided by peak-load pricing to reduce its operating costs. However, in most industries overcapacity is a cyclical phenomenon, which correlates closely with the business cycle (or with market demand, which fluctuates from one time to another). In a period of economic downturns, capacity is under used, and its use rate eventually moves back up as the economy recovers. Unemployed capacity under this circumstance is therefore a temporary situation. On the other hand, chronic overcapacity results when the demand for a product has been declining persistently or stagnated for some time. This is the kind of unemployed capacity that could be used off peak.

Among the nine industries studied, the iron-foundries seem to have an edge over the others once more. This is because of its low utilization factor in relation to its installed capacity. It is reported that with only minimal capital outlay, this industry could produce twice as much as it did in 1971.[29]
The same thing cannot be said about the other members of the group. Their capacity utilization varies in a way reflecting general economic conditions, and would not be suitable for shifting consumption of electricity. To exploit the off-peak provision to the fullest, additional capacity facilities are required in these industries. Most firms could still take some advantage of the off-peak rate even without planning added investment.[30]
The point is, additional capacity is usually a condition of making the maximum use of the provision.

However, additional investment is not optimal if total costs exceed total benefits. The past record indicates that the relatively high capital cost of electricity equipment acted as a constraint on electricity consumption. That is to say, there would have been a more pronounced substitution of electric powered capital for other capital and labour in manufacturing in Ontario if it were not for the relatively expensive capital equipment which was necessary for large electrical installations.[31]
By a similar reasoning, it is doubtful whether many industrial customers would undertake to expand on a large scale merely to take full advantage of these rate differentials. If the differentials were to be much larger, the results might differ.

In conclusion, costs associated with relocating production to off-peak hours, and thus taking advantage of peak-load pricing to the fullest, may be too high to make the shift economical for some power-intensive industries.
However, these industries could minimize the impact of a change in the rate structure through different techniques (for instance, re-scheduling the power-intensive part of the manufacturing process to off-peak periods and maintaining off-peak operation at times of weak demand). Consequently, the overall impacts are expected to be small. The conclusion should be viewed in a broader framework. At present no distinction is made between on-peak and off-peak consumption, even though it costs more (in terms of long-run incremental cost) to supply electricity during the peak period.

One serious consequence of this lack of price differentiation is the inefficient allocation of resources. With rates based on marginal costs, however, for any amount he consumes during the peak, a user will have to pay the full cost of production of peak power; and off-peak users would no longer subsidize his consumption. It follows that if a producer wants to maintain a least-cost operation he must take advantages of the off-peak provision whenever possible. Similarly, facing a new rate structure, an off-peak user can maximize his utility, or minimize his costs. The resulting consumption patterns will lead to the efficient allocation of resources devoted to producing electricity.

E. INDUSTRY RELOCATION

Questions have been raised about how many industrial customers may be induced to relocate their plants because of rate increases. The decision to relocate depends on several factors; For purposes of analysis, though, it is assumed that other determinants of location,(such as transport, market, labour supply, and raw materials) have not changed, and that any industrial relocation is therefore to be attributed solely to higher prices for electricity.

1. Demand Elasticity for Output

As discussed above, the demand elasticity can measure how much of higher input costs producers can pass along. If an industry manages to shift the burden of rate increases to its customers, there may be no reason why it should relocate. If on the other hand it has to absorb the additional operating-expense, and thus receive a lower level of profit, then it might find it worthwhile to go elsewhere.

Important though it is, the elasticity of demand for all industrial products in question has not been estimated; the present state of the art and the lack of studies for individual products made that impossible. It is therefore also impossible to know what share of their added cost of electricity industries could transmit to their customers. Nonetheless, our analysis of profitability ratios indicates that some industries (pulp and paper, for instance) should find it harder to pass on such increases than others (such as petroleum industry).

2. Electricity Cost as a Proportion of Total Costs.

Electricity cost as a percentage of total value added for the nine electrically intensive industries is shown in Table E-1. Except for abrasives, none of them used more than nine cents of electric power per dollar of value added in 1972. In such industries as iron foundries, petroleum, and coal products, electricity accounted for less than four cents.

Informative though it is, electricity use in the past, is of limited use if it tells us nothing about use in the future. The data in Table E-1 are plotted in Figure E-1, in order to give some idea of future use of electricity in these industries. The nine panels indicate an unmistakable shift towards high intensity of electricity use in recent years in most of the industries (a notable exception is smelting and refining) If that trend persists, one can expect electricity to account for a larger share of the value added. The greater the electric-power content of a product, the more important electricity is for determining the location of the industry. Extrapolating the past trend electricity as a percentage of value added (see Figure E-1) for the products of the seven industries in 1978 would appear as in the accompanying table.

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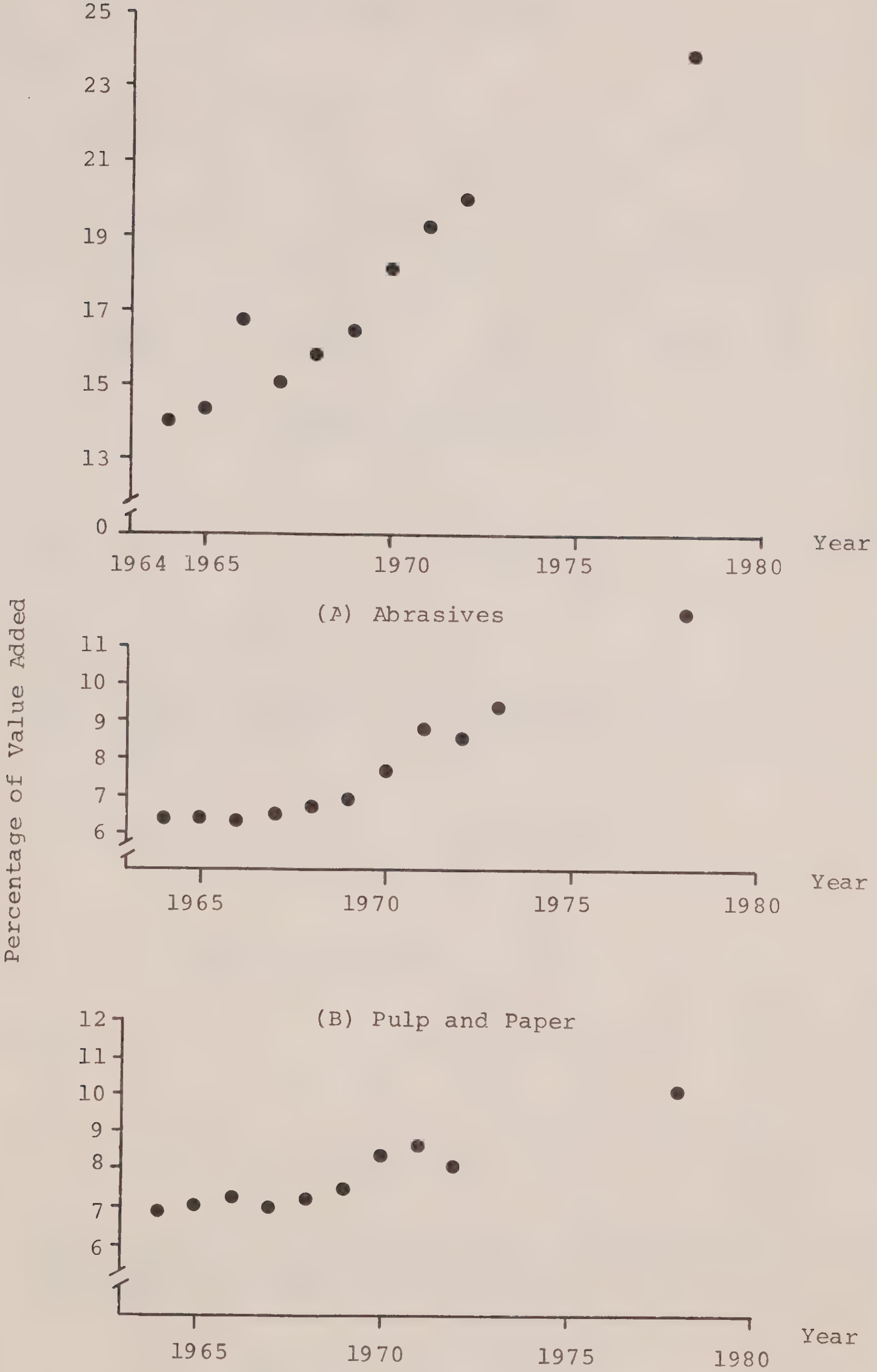
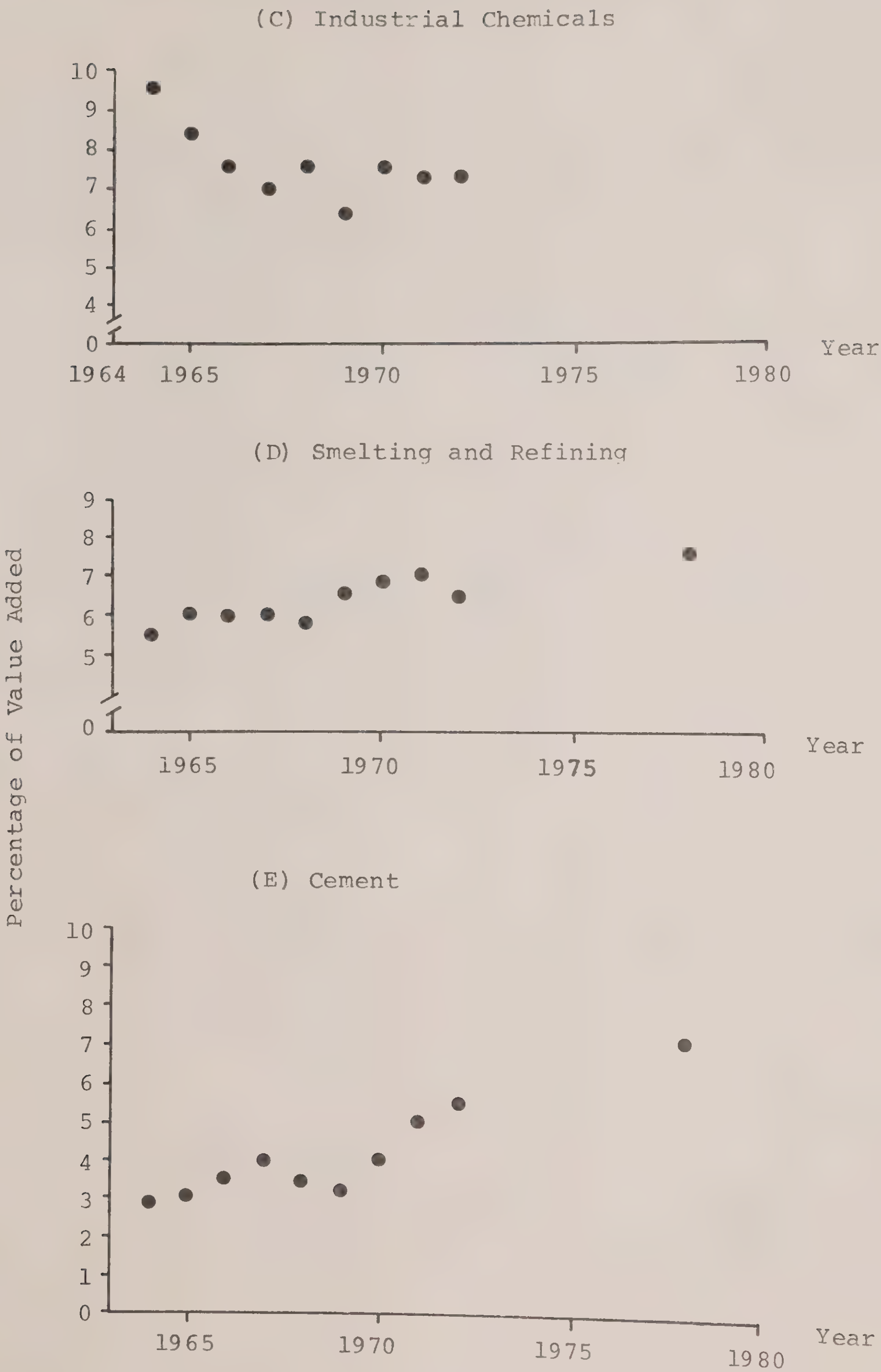
[29]Ibid

[30]A case in point is Lake Ontario Cement. Its management says that the firm would switch some daytime grinding operation to the night shift, but that additional capital investments solely for the purpose of shifting usage heavily to the nighttime hours would not be cost effective with the energy rate differentials in Scenario B.

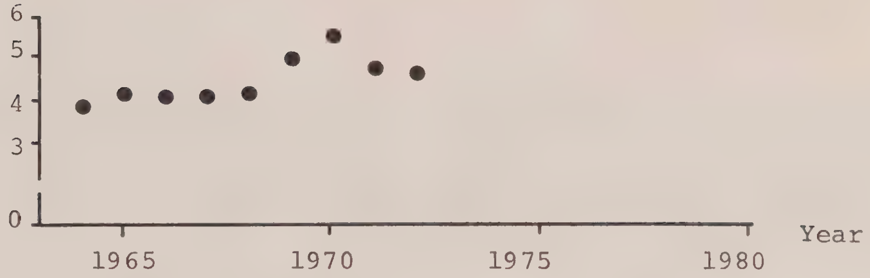
[31]*Utilization and Conservation of Electricity in Industry in Ontario*, pp. 38-39.

Electricity Cost As A Percentage of Value Added in Various Industries

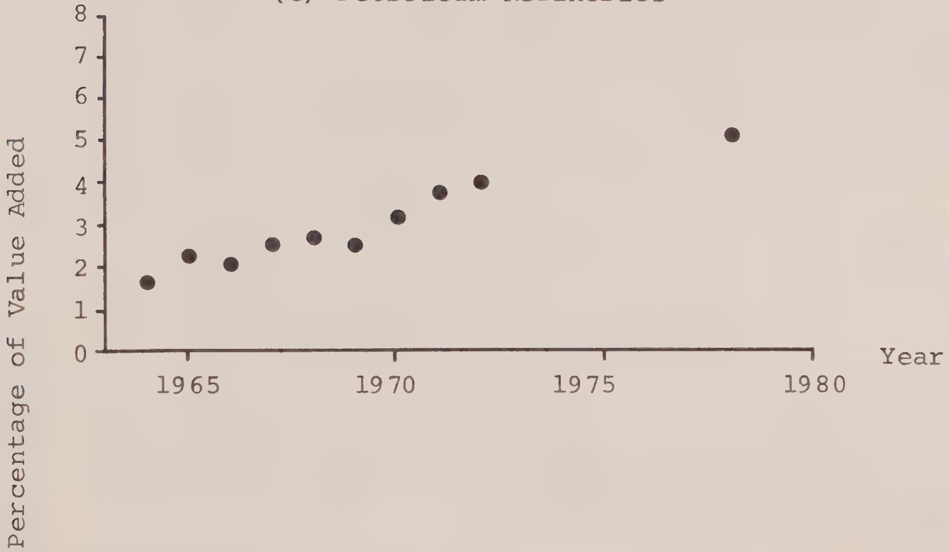



(C) Industrial Chemicals
10
9
8
7
6
5
4
0
1964
1965
1970
1975
1980
Year
(D) Smelting and Refining
9
8
7
6
5
0
1965
1970
1975
1980
Year
(E) Cement
10
9
8
7
6
5
4
3
2
1
0
1965
1970
1975
1980
Year
Percentage of Value Added

(F) Lime



(G) Petroleum Refineries



(H) Iron Foundries

(I) Other Petroleum Products

Based on Table 15

TABLE E-1

Cost of Electricity As A Percent Of Value Added
Select Ontario Industries, 1964-1972
(Per Cent)

	1964	1965	1966	1976	1968	1969	1970	1971	1972
Abrasives	13.9	14.3	16.7	15.1	15.7	16.4	18.1	19.2	18.8
Industrial Chemicals	6.8	6.9	7.2	6.9	7.1	7.4	8.3	8.6	8.0
Pulp and Paper Mills	6.3	6.3	6.2	6.4	6.6	6.8	7.6	8.7	8.5
Smelting & Refining	9.5	8.3	7.6	6.9	7.5	6.3	7.5	7.1	7.3
Cement	5.5	6.0	5.9	6.1	5.8	6.5	6.7	7.0	6.4
Lime	2.7	3.0	3.4	3.9	3.4	3.1	3.9	4.8	5.4
Petroleum Refineries	3.7	4.0	4.0	4.0	4.0	4.8	5.5	4.6	4.4
Iron Foundries	1.6	2.2	1.9	2.4	2.7	2.6	3.1	3.7	3.9
Other Petroleum Industries	1.5	1.2	1.1	1.1	1.4	2.4	2.7	3.3	3.5

Source: Calculated from Ontario Hydro, Utilization and Conservation of Electricity in Industry in Ontario.

Industry	Cost of Electricity As % of Value Added
Abrasives	23.7
Pulp and Paper	11.8
Industrial Chemicals	10.0
Cement	7.5
Lime	7.0
Iron Foundries	5.0
Other Petroleum	5.6

True, under these circumstances electricity would become a more important factor in location. Nevertheless, it must be stressed that a slight percentage increase does not usually transform electricity into the crucial factor, for other factors such as labour and transport may remain predominant see 4. below. Moreover, the estimates are suspect for two reasons. First, it is not clear that the past trend will continue far into the future, or even past 1978. Second, in the face of rapidly increasing electricity rates, manufacturers may well undertake some sort of conservation and substitute relatively cheaper factors for higher-priced electric power. Consequently, the increase in intensity of use of electricity, if it does occur, will be lower than the figures presented above.

3. Availability of Cheaper Electricity in Other Jurisdictions.

In this chapter, lower rates for electricity are assumed to be the one and only incentive for a businessman who contemplates relocating. Electricity prices in various regions will therefore be investigated and analysed here.

Past developments in central Canada show that the availability of cheap electric power can affect the locational decisions of power-intensive industries, most of which use electricity for smelting, refining, or electrolytic processes.[32]

[32]Interested readers should consult Schramm, "The Effects of Low-Cost Hydro Power on Industrial Location", and Dales "Fuel, Power and Industrial Development in Central Canada".

The pertinent question here is whether the historical cost advantage of hydraulic power still holds for the present and the foreseeable future. Figure E-2 and Table E-2 present the growth in Canada of generating-capacity and installed generating-capacity respectively. It is beyond doubt that hydraulic power will remain an important source, but its share of total capacity has been decreasing. At the same time nuclear generation continues to grow. Projections current in 1975 show that by the end of 1985 hydro-electric plants will provide 56 per cent of Canada's total generating-capacity conventional thermal plants 29 per cent, and nuclear plants the remaining 15 per cent.[33] However, the recent emergence of problems of capital availability casts doubt on the plans of provinces heavily committed to nuclear generating-stations, which require great capital outlays.

Most of Ontario's available hydraulic potential has already been developed.

Emphasis is therefore being placed on nuclear capacity which accounted for 13 per cent of Ontario's total (see Figure E-3 and Table E-4). On the other hand, Quebec and British Columbia still have large hydraulic reserves. But these statistics are somewhat misleading, in that most of the accessible low-cost power sites have already been developed so that new installations can only be made at increasing costs. As things stand, only a few sources in British Columbia, the Nelson River in Manitoba, and the second phase of the James Bay Project[34] in Quebec could still offer economically attractive hydro-electricity.[35] What is of concern here is whether Ontario can come to rely on nuclear power and still maintain a rate schedule competitive with those of British Columbia and Quebec.

Although the rates of Ontario Hydro remain among the lowest in North America, Tables E-5 and E-6 show lower-priced electricity in Quebec, British Columbia, and Manitoba. At first glance there appears to be ground for enterprises to consider relocating in other provinces. But the appearance is deceptive. As an industrial location parameter, the absolute level of power rates is not

[33]Department of Energy, Mines and Resources, *Electric Power in Canada*, 1973, p. 12.
[34]Expected to be in production at the end of 1979.
[35]See Economic Council of Canada, *Economic Targets and Social Indicators.*

TABLE E-2

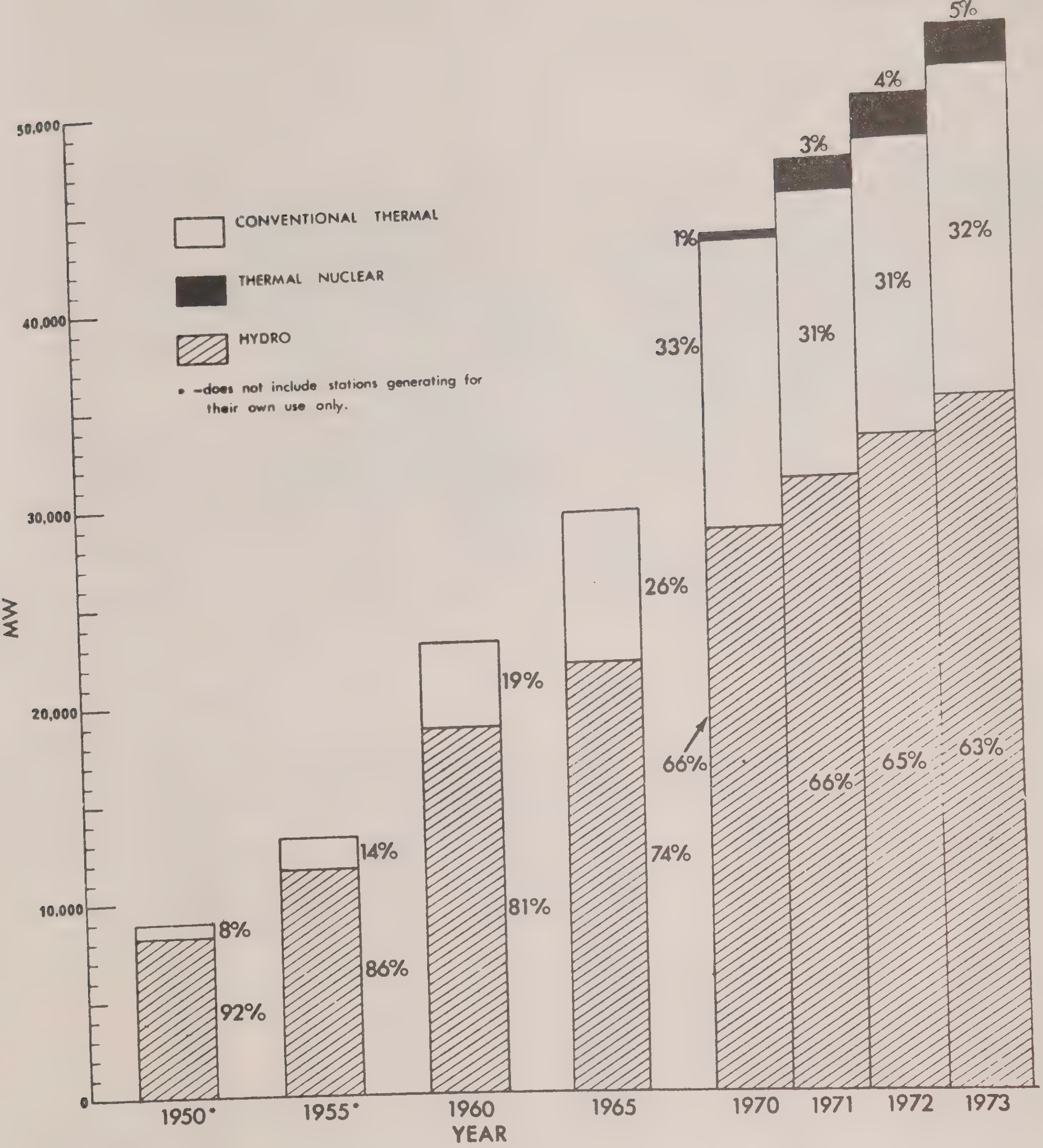
INSTALLED GENERATING CAPACITY IN CANADA 1920-1971* (MW)

Year	Thermal Conventional	Thermal Nuclear	Total	Hydro	Total
1920	300	—	300	1,700	2,000
1930	400	—	400	4,300	4,700
1940	500	—	500	6,200	6,700
1950	900	—	900	8,900	9,800
1955	2,100	—	2,100	12,600	14,700
1956	2,425	—	2,425	13,425	15,850
1957	2,651	—	2,651	14,518	17,169
1958	2,876	—	2,876	15,683	18,559
1959	3,573	—	3,573	17,536	21,109
1960	4,392	—	4,392	18,657	23,049
1961	5,072	—	5,072	19,019	24,091
1962	5,609	20	5,629	19,338	24,967
1963	6,180	20	6,200	20,101	26,301
1964	6,694	20	6,714	20,313	27,027
1965	7,557	20	7,577	21,771	29,348
1966	8,087	240	8,327	22,438	30,765
1967	9,373	240	9,613	23,353	32,966
1968	10,711	240	10,951	24,957	35,908
1969	12,321	240	12,561	27,031	39,592
1970	14,283	240	14,523	28,293	42,816
1971	14,507	1,570	16,077	30,601	46,678

*Figures appearing for 1955 and earlier are only approximate since they have been computed using actual Statistics Canada data for stations generating energy for sale to which have been added estimates for stations generating entirely for their own use.

Source: Canada, Department of Energy, Mines and Resources, Electric Power in Canada 1973, p. 8

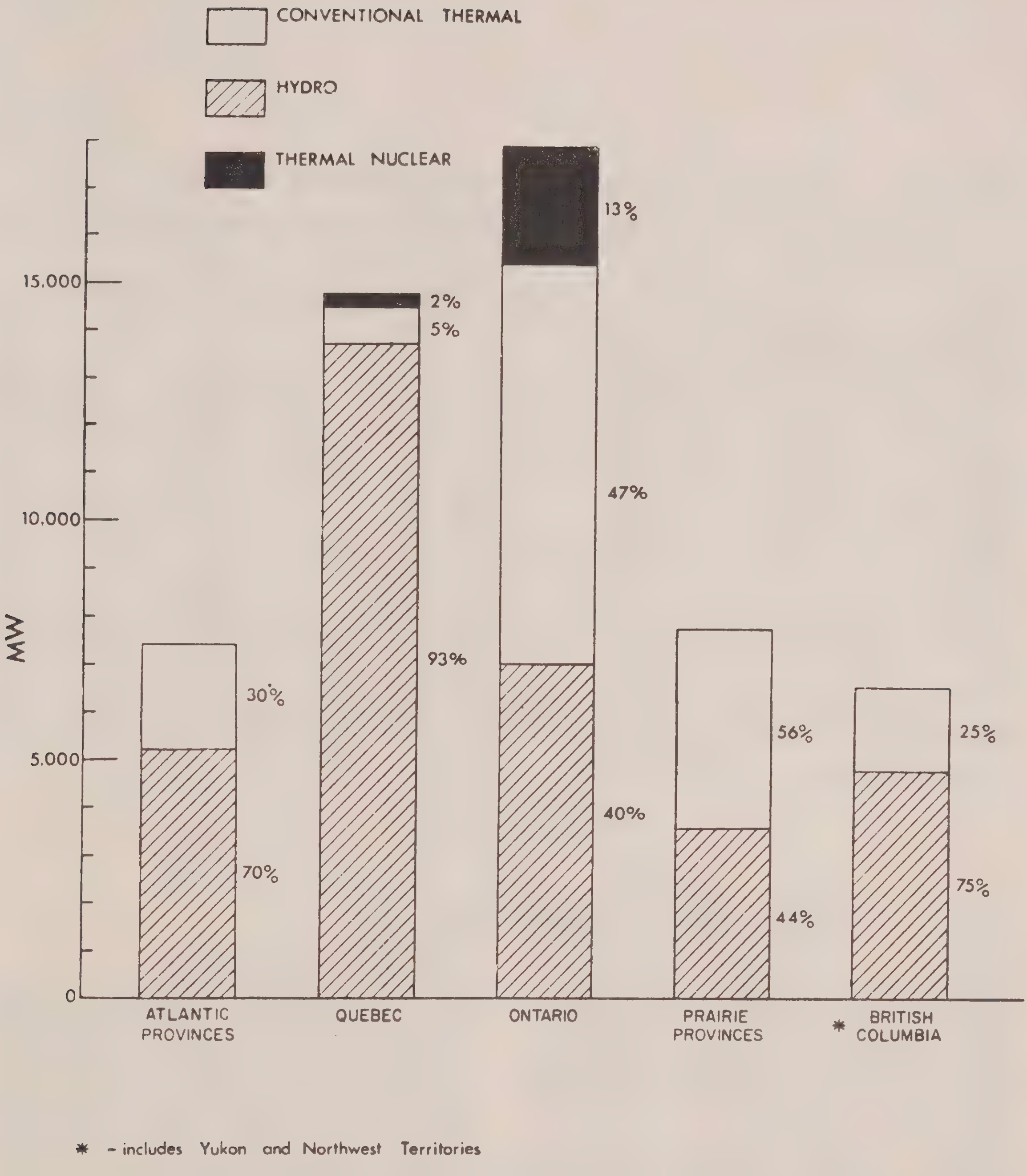
FIGURE E-2



Growth of Generating Capacity in Canada, 1950-1973.

Source: Dept. of Energy, Mines and Energy, <u>Electric Power in Canada 1973</u>, p. 45

FIGURE E-3



Installed Generating Capacity in Canada by Region, 1973.

Source: Department of Energy, Mines and Energy, <u>Electric Power in Canada 1973</u>, p. 2

TABLE E-4

INSTALLED GENERATING CAPACITY AT DECEMBER 31, 1973 (MW)

Province/ Territory	Steam Conven-tional	Steam Nuclear	Internal Combustion	Gas Turbine	Total Thermal	Hydro	Total
Newfoundland and Labrador	347	—	56	28	431	4,300	4,731
Prince Edward Island	71	—	7	40	118	—	118
Nova Scotia	1,013	—	7	25	1,045	160	1,205
New Brunswick	619	—	8	23	650	680	1,330
Quebec	676	266	62	36	1,040	13,800	14,840
Ontario	7,897	2,400	35	364	10,696	7,008	17,704
Manitoba	423	—	23	28	474	2,169	2,643
Saskatchewan	1,086	—	33	89	1,208	567	1,775
Alberta	2,446	—	43	198	2,687	718*	3,405
British Columbia	1,136	—	142	265	1,543	4,803	6,346
Yukon	—	—	36	—	36	26	62
Northwest Territories	1	—	74	2	77	35	112
Total	15,715	2,666	526	1,098	20,005	34,266*	54,271
Net Additions 1973	1,915	540	17	102	2,574	1,749*	4,323
Percentage Increase Over 1972	13.9	25.4	3.3	10.2	14.8	5.4	8.7

*Bighorn Rating Change — 18 MW reduction from 1972.

Source: Canada, Department of Energy, Mines and Resources, Electric Power in Canada 1973, p. 10

of great consequence. What is more significant is the relative cost of electric power in Ontario, when compared with those jurisdictions. Our task would be simpler if all utilities adopted comparable rate schedules. Unfortunately, this is not the case, rendering any comparison of bills hazardous. Hence the analysis that ensues does not intend to investigate any supposed absolute rate differentials between Ontario and other jurisdictions, but the direction of the differentials.

Like their counterpart in Ontario, which raised its price to industrial customers by an average of 14 per cent (calculated from Tables E-5 and E-6), utilities in other jurisdictions found themselves compelled to do the same. In particular, B.C. Hydro and Manitoba Hydro raised their prices by approximately 25 per cent, a higher percentage than in Ontario. Since their rates have not changed as often and the original rates were lower, rates forecast for Quebec and Manitoba Hydro are lower than for Ontario. Yet Quebec Hydro succeeded in lowering the price for some customers while raising it for the others, leaving its electricity rates virtually unaltered. This increasingly widening gap may prove to be a potential threat to Ontario.

4. Advantages of Existing Locations

Established centres of industry do not normally decline merely for lack of enough new low-cost electrical facilities to meet growing industrial demand; for old centres retain transport, market, labour, and other advantages. Hence, a limited supply of hydro-electricity can by no means obscure the favourable conditions Ontario has established for itself. In the first place, its population, which is the largest in Canada and enjoys one of the highest incomes, per capita provides a large consumer market as well as a market of skilled labour; and of course, its proximity to the industrial heartland of the United States augments these potential markets. Secondly, other factors, such as a capital market and a transport network, have been well developed.

When a manufacturer decides to leave the province and relocate elsewhere in Canada, he could lose many of these advantages. Therefore, an industry, no matter how electrically intensive it is, must weigh those losses against the potential gains from relocation, such as lower rates for electricity and possibly lower labour rates where they exist.

F. CONCLUDING REMARKS

We have investigated in this study the effect on employment of

TABLE E-5

INDUSTRIAL RATE COMPARISONS
PUBLISHED SCHEDULES

			Load:	5,000 kW	Load:	10,000 kW
			Load Factor:	80%	Load Factor:	80%
			Energy:	2,920,000 kWh	Energy:	5,840,000 kWh
Company	Eff.Date	KV	Monthly Bill	Mills/kWh	Monthly Bill	Mills/kWh
Ontario Hydro	Jan.1/74	12-60	26,720.00	9.15	53,440.00	9.15
B.C. Hydro	Sept/73	60 & over	19,870.00	6.81	39,742.00	6.81
TVA	Jan.2/74	46-161	26,684.80	9.14	53,369.60	9.14
Quebec Hydro	Jan.1/73		25,542.00	8.75	50,246.00	8.61
Niagara Mohawk	Jan./72		29,287.83	10.03	58,330.71	9.99
Detroit Edison	Aug./71		34,057.20	11.66	67,046.40	11.48
Commonwealth Edison	Oct./72		31,102.07	10.65	60,246.54	10.32
Manitoba Hydro	Apr.1/74	20-80	23,815.00	8.16	47,455.00	8.13
Windsor P.U.C.	Mar.1/74	27.6	28,710.00	9.83	57,420.00	9.83
Oshawa P.U.C.	Apr.1/74	44	28,806.00	9.87	57,612.00	9.87
Hamilton H.E.C.	Mar.1/74	13.8	26,840.00	9.19	53,680.00	9.19

Source: Ontario Hydro, Power Market Analysis, June 13, 1974

TABLE E-6

INDUSTRIAL RATE COMPARISONS
PUBLISHED SCHEDULES

			Load:	5,000 kW	Load:	10,000 kW
			Load Factor:	80%	Load Factor	80%
			Energy:	2,920,000 kWh	Energy:	5,840,000 kWh
Company	Effective Date	KV	Monthly Bill $	Mills/kWh	Monthly Bill $	Mills/kWh
Ontario Hydro	Jan. 1/75	12-60	30,500.00	10.45	61,000.00	10.45
B.C. Hydro	Aug. 1/75	60 & over	24,869.50	8.52	49,741.90	8.52
T.V.A.	July 1/75	13	46,152.00	15.81		
T.V.A.	July 1/75	161			90,180.00	15.44
Quebec Hydro	Jan. 1/75	69	23,650.00	8.10	46,600.00	7.98
Niagara Mohawk	Mar. 11/75		51,361.89	17.59	101,760.53	17.42
Detroit Edison	Feb. 4/75		63,391.40	21.71	126,482.80	21.66
Commonwealth Edison	Feb. 18/75		56,311.38	19.28	110,715.58	18.96
Manitoba Hydro	Apr. 15/75		30,181.80	10.34	60,002.60	10.27
Windsor P.U.C.	Jan. 1/75	27.6	32,000.00	10.96	64,000.00	10.96
Oshawa P.U.C.	Jan. 1/75	44	33,100.00	11.34	66,200.00	11.34
Hamilton H.E.C.	Mar. 1/75	13.8	29,586.00	10.13	59,172.00	10.13
Bonneville Power Administration			10,453.00	3.58	20,906.00	3.58

Source: Ontario Hydro, Power Market Analysis, July 1975

an increase in rates for electricity. It was found (under a set of unrealistic and static assumptions) that an increase of 75.9 per cent over three years would reduce the total number of employees work in nine electrically-intensive industries by 8.0 per cent. Later, relaxing assumptions modified this figure to less than 2 per cent over the same period. The impact of the rate increases on industrial relocation was also analysed. The finding was that the widening rate differentials between Ontario and Quebec might put Ontario at some disadvantage. But then, Quebec lost ground in terms of other factors of location (such as political stability and skilled labour). Should it consider relocation, an enterprise would have to assess the trade-off between a lower rate and an established location. In general, rate differentials have to be very large to justify relocating.

Overall, in view of the minimal effect they have imposed on electrically-intensive industries, rate increases are not expected to exert any great impact on industries which use far less power, or on the Ontario economy as a whole.[36]
This conclusion should be qualified somewhat. There might be some temporary unemployment. However, resource relocation should not be considered undesirable. For these rate increases mean essentially that the real cost of supplying electricity has increased, and industry therefore has to use electricity more efficiently.

Jurisdictions where electrical output exceeds the optimum must be ready to reallocate these resources. That is the way the market system operates; and in the longer run, society as a whole will benefit.

Our conclusion is further substantiated by the forecast made recently by the Economic Council of Canada. An examination of Table F-1 confirms that 1975 was a year of below-average economic performance for Canada. A recovery is expected in 1976 and the years after. Of special interest is the projection which forecasts a declining rate of unemployment. Given that the unemployment rate in Ontario is historically below the national average, unemployment should pose a smaller problem in the years ahead than it does now. If so, a preoccupation with the impact of higher rates for electricity employment may be unwarranted (Compare the conclusions of Chapter III).

The present study also analyses the potential impact of a change in rate structures on the electrically intensive industries. Proponents of marginal-cost pricing argue that the current system does not adequately reflect the actual cost of producing electricity. Thus a four-part tariff based on estimated marginal costs has been put forward as an alternative. Our finding is that the power-intensive industries might have to pay a little more if the proposal is accepted and implemented, but electric power would be used more efficiently, improving the allocation of resources. Efficient allocation, needless to say, benefits society as a whole.

A final word of caution is in order. This study is essentially a partial equilibrium analysis, in the sense that no attempt has been made to explore the adjustment process taking place simultaneously throughout the whole economy; or our methodology does not allow that.

[36] A study of similar nature done by the Tennessee Valley Authority comes up with the same conclusion: "The impact of increase in Relative Power Cost (the relative cost of electric power in the TVA region when compared with surrounding area) on total employment is relatively minor". See Bohmand Eblen, *The Projected Impact of Power Rate Increases on Employment*.

Table F-1

Selected Performance Indicators, 1974-1978

	1975	1976	1977	1978
		(per cent)		
Average annual change in:				
Gross national expenditure	- 0.5	7.1	6.6	5.7
Consumer expenditure	2.7	6.5	5.8	6.2
Total fixed investment	- 2.4	7.2	7.4	7.1
Machinery and equipment	0.9	12.6	8.9	6.2
Non-residential construction	6.0	0.5	8.1	10.5
Residential construction	-22.8	9.0	6.2	8.0
Exports	- 7.4	7.9	7.5	5.1
Imports	- 7.4	8.1	8.0	7.2
Output per person employed in manufacturing	- 2.6	5.3	5.0	4.2
Employment	1.3	3.2	3.9	3.4
Unemployment	7.6	6.6	5.4	4.5

Source: Globe and Mail, 23 December 1975.

III. LONGER-TERM IMPACTS: 1980 AND BEYOND

A. INTRODUCTION

As was stated in Section II, the chief object of this chapter, is to investigate and assess the potential impacts of the forecast power-rate increases, and of a proposed change in rate structures, on Ontario industry over the years 1976 to 1978. Little effort has been expended so far to find out how the anticipated impacts fit in to a macroeconomic framework, namely the Ontario economy, in a more distant future. This chapter is a partial attempt to fill the missing link. Specifically, it will look at the supply and demand situation for energy in general and how it can be related to Ontario's industrial structure; furthermore, we shall study the change that will take place in Ontario's economy as it reaches a mature stage.

B. ENERGY SCARCITY AND ITS AFTERMATH

1. Energy: Supply and Demand

In Section II we took the increases in the price of electricity for granted. No questions were asked about how they came into being. A close inspection, however, reveals three main causes. These are general inflation, relative increase in fuel costs, and a change in generation mix. The first two causes are self explanatory. Over the years 1940 to 2000, three types of generation predominate at various times in Ontario. For the time when the system was primarily hydraulic in the 1940s, a relatively level cost of around $60 a kilowatt (in 1975 dollars) is estimated. This is followed by a steady rise from 1950 to 1980, when the system is forecast to change from predominantly hydraulic to predominantly nuclear and fossil. Then the cost is expected to stabilize. During this period, nuclear is expected to increase in proportion to total generation at the expense of fossil and hydraulic.[37]

However, no significant substitution of other forms of energy for electricity is foreseen, because their prices are forecast to rise rapidly too. The price increases stem basically from the widening discrepancies between supply and demand of competing fuels (we have in mind primarily oil and gas).[38]
As things now are, Canadian production of crude oil has declined since 1974 and will reach a low in 1986. Figure III-1 gives a more precise projection of the shortfalls between the amount of crude oil available and the amount demanded.

The outlook for supply and demand in natural gas is not much brighter. From 1976 to about 1982, Canadian gas users are likely to be faced with a steadily worsening supply situation. The submissions of oil and gas companies to the National Energy Board in 1976 showed even gloomier projections about making new finds, laying new pipelines, and bringing the oil sands into production.

2. Implications

a. General

This situation clearly implies that energy consumption needs to be restrained in Ontario, which greatly depends on coal and oil from outside. As was predicted earlier, the past trend, which shows declining energy use per unit of product, is likely to accelerate. Improved management practices can result in substantial energy savings in the short run, but the principal solution lies in the substitution of capital embodying new technology for energy. In addition, there may be a shift within manufacturing away from the energy-intensive industries, as a group, and toward the less energy-intensive industries. This is a natural response to the relative rise in energy prices, which favours the less-energy intensive industries. In this connection one may perceive slower growth in such large energy users as primary metal industries; stone, clay, and glass for one, and paper for another.[39]

Another implication of the energy outlook is that energy-deficient areas, such as Ontario, must settle for slower rates of industrial growth and slower resource development. To say that is not the same thing as suggesting zero growth for the province. It means in essence that Ontario may be much better off leaving energy-intensive industries to areas which have a comparative advantage in energy resources, and concentrating instead on technologically intensive and labour-intensive industries as its economy matures. (More on this in (c) and 3). However, as H.D. Leach observes 'Few politicians or businessmen are yet prepared to come out in the open and advocate slower rates of development and more detailed constraints on urban and population growth.[40]

b. Ontario and the Location of Industry

We mentioned in Section II that established industrial centres do not normally decline simply because their limited energy resources are inadequate to meet industrial demand. For they retain such transport, market, labour, and other advantages as they previously possessed. As will be shown presently, Ontario is in precisely such a position. Aside from being the chief financial centre of Canada and the centre of its transport routes Ontario, has had the highest personal income per capita and even though it has now lost this lead to Alberta, its level continues to rise. It should also be observed that Ontario households, while serving as a large market for consumer-goods,[41] provide industries with a pool of reliable and highly skilled labour. If educational levels are of any indication of skills and training, Table III-2 is informative. It lends support to the belief that Ontario labour is highly trained.

The Ontario economy will enjoy an advantage over jurisdictions that do not implement marginal-cost pricing. These other jurisdictions may under-price their electricity, thereby siphoning off resources from potentially more desirable activities.[42] Furthermore, one cannot overlook the importance of foreign investment in Canada's economic development. There is no question that U.S. direct investment has contributed substantially to the regional growth of manufacturing in Canada. As a result of its proximity to New England and adjacent industrial states, the percentage of manufacturing owned and controlled by U.S. nationals is higher in Ontario than in the rest of Canada. This is due to the need for branch plants to remain near their markets and their sources for labour and materials.[43]

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[37]Ontario Hydro, *Effects of Changes in Generation Mix on the Cost of Electricity*.
[38]This paragraph and the next rely on a report featured in *The Financial Post*, 29 November 1975, p. 27.
[39]Industries which depend on non-renewable energy resources for their feedback - plastic and chemical, for example - may be hampered in their growth, too, as these resources become depleted. They must therefore use less energy on the one hand and look for substitute raw materials on the other.
[40]*Financial Post* p. 16.
[41]These are domestic markets. New England and adjacent states, on the other hand, provide for good foreign markets, not far away from the site of production in Ontario.
[42]Benefits that accrue from the implementation of marginal-cost pricing have been detailed in Volume I. Suffice it to repeat that marginal-cost pricing induces efficiency and encourages conservation, so that electricity that would otherwise have been wasted can be channelled to productive activities such as energy research and recycling of non-renewable resources (such as aluminum and iron).
[43]For a detailed investigation of the relationship between the locations of the parent company and the subsidiary, see Ray, *Market Potential and Economic Shadow*.

FIGURE III-1

CANADIAN ENERGY PROSPECTS: 1976-1990

Domestic demand and availability: oil (1970-1990; high-price scenario)

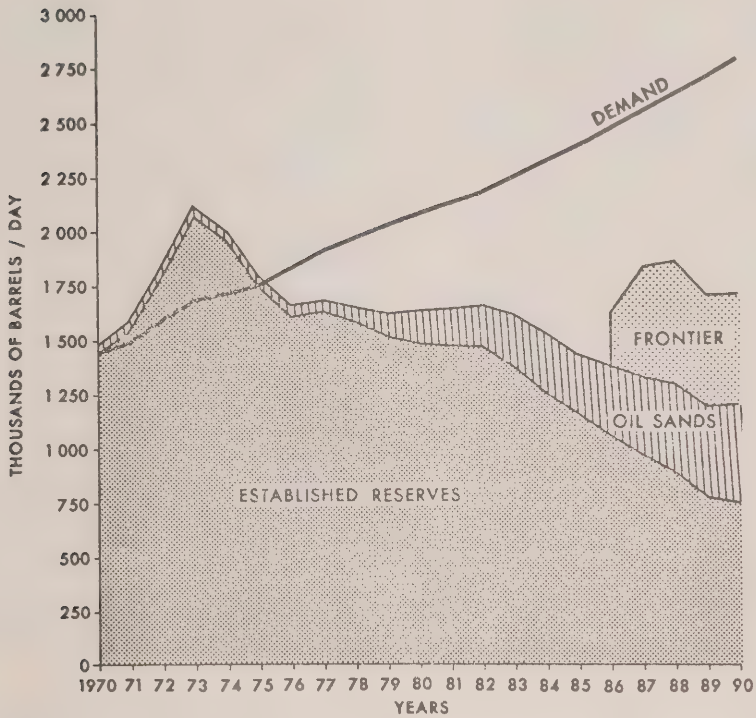

Table III-2

Percentage of Male Population in Selected Educational Categories (1 June 1961)

	Canada	Maritimes	Que.	Ont.	Prairies	B.C.
percentage who did not go beyond elementary school	52.4	59.0	59.2	48.9	50.7	40.2
percentage with university degree	4.0	2.3	4.0	4.7	3.4	4.3

Source: F.T. Denton, An Analysis of Interregional Differences in Manpower Utilization and Earnings (Economic Council of Canada, Staff Study No. 15), Ottawa, 1966.

From its own viewpoint, Ontario is energy deficient compared to Alberta, Quebec, and B.C.[44]
The U.S. industries which depend on Canada for energy inputs and on Ontario for markets may look at the matter differently. In its latest report, the National Energy Board recommends the oil exports to the United States be cut to an average of 460,000 barrels a day in 1976, and completely eliminating in 1981.[45] Faced with such a prospect, these industries may find it necessary to move to Canada; and if proximity to the Ontario market is a strong cost factor, they may move there. The province could assure these firms of a reliable supply of electricity if its nuclear program could overcome the problems of capital availability.

It is plain, then, that the Ontario economy will not stop developing abruptly and become stagnant as a direct result of its endowment of energy resources. More probably, industry will come to grips with the energy problem and adapt itself to less energy-intensive operations. In this regard (remember that research facilities are readily available in Ontario), industries producing energy-conserving and anti-pollution equipment, and also such industries as uranium mining, are likely to locate in Ontario to supply the provincial manufacturing sector and the whole of Canada. The tendency towards less energy-intensive production will be reinforced by the ever-growing service sector as Ontario enters the 1980s and as its economy matures further. Government activity may include planning and hastening these developments to mitigate the impacts of energy scarcities. Intervention to retain industries that might be more economic near the sources of hydrocarbons could involve subsidies that may not be in the interest of the province. More jobs can be created in expanding commerce and service sectors, which are not energy-intensive but are labour-intensive. However, since productivity is usually lower in those sectors than in more heavily capitalized ones, the income per capita will probably continue to rise more quickly in provinces better endowed with energy than in Ontario.

C. ECONOMIC DEVELOPMENT AND ONTARIO

This section will discuss how, in a developing economy, growth in employment tends to take place mainly in the 'tertiary' sector, which is made up mostly of commerce and services. Since Ontario lacks coal, oil, and gas, and is having trouble raising capital for nuclear plants, and also for reasons connected with the balance of payments, government may use development policy to speed growth of employment in the service sector.

1. Industrial Structure of Workforce

In the course of industrial development, employment in both the secondary and tertiary sectors grows very rapidly. The main source of labour for this is agriculture. As a country becomes more industrialized, there is a steady flow of labour from rural to urban areas, and the percentage of the labour force engaged in farming falls dramatically. But for that very reason the percentage of addition to the labour force in the secondary and tertiary sectors that comes from this source declines over time. Tables C-1 and C-3 present a general overview of industralization of various countries, and provide solid evidence for this generalization.

With the preceding information as background, let us briefly focus our attention on several industrially advanced nations. It can be seen from Table C-2 that the absorption of labour into services was very substantial in all countries. Particularly, in the slow-growing countries the rate of growth of labour in the industrial sector tended to lag behind the rate in the tertiary sector, although in rapidly growing countries such as Japan and Italy it was the other way round.[46]

2. The Case of Ontario

It is indicated in I that employment in tertiary activities is lowest in the underdeveloped countries and highest in the more developed parts of the world. (See also Table C-1.) Canada has seen faster growth in its tertiary than in its secondary sector (Table C-2). In point of fact, over half the Canadian work-force is employed by the service industries. For illustrative purposes, Table C-4 shows the labour force distribution by major industry groups during the years 1931-1961. Of all the service industries, trade and community and business service turned out to be the leading employers in 1961.

Ontario is indisputably the industrial heartland of Canada. Its growth rate reflects its stage of development on the one hand, and greatly influences the industrialization rate of the nation on the other. In the foreseeable future, Ontario will likely maintain this predominance, notwithstanding possible faster growth in Alberta, British Columbia, and perhaps Quebec. The reason is that industrialization is a slow-moving process; and given the well established position of Ontario, it will take those provinces quite some time to catch up. Yet as Ontario matures further, the tertiary sector could very well become the overriding source of new employment.

If considerations of the balance of payments prevent importing foreign oil on a large scale, and the parts of Canada well endowed with gas and oil adopt a policy of preventing shipments to other provinces until they have met their own needs, then some industries may move to those parts to obtain a secure supply of energy. Ontario may then have to choose between finding capital for competitive nuclear development (or solar development, which in the long run would also required large amounts of capital) or deliberately redirecting its growth towards the service sector.

D. CONCLUSIONS

Demand in excess of supply underlies the energy problem which will face every Ontario resident in the future. The stark reality is, at any given time (for the next fifteen years, at least) there is only a certain amount of energy available. Society therefore must not hope to satisfy every would-be consumer at once.

There are basically two conflicting, but not necessarily mutually exclusive, ways to solve the problem. The first is governmental action: legislation to ration supply and impose mandatory conservation measures, and (equally important) to direct resources towards the energy sector in order to assure and/or enhance the supply.

The alternative means is the price mechanism, with the price signal, rather than a government agency, effecting the allocation. The price of energy increases in response to excess demand; higher price discourages demand and stimulates production of the supply side. There is then no need to interfere with the autonomy of the consumer.

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[44]An exception is uranium. Its abundance will prove to be an asset to the province as Ontario Hydro relies more and more on nuclear generation to provide electrical service.

[45]*Financial Post* p. 27.

[46]See, for example, Ostry and Zaidi, *Labour Economics in Canada*, 2nd ed., Ch. 4

*Trends in distribution of labor force, by economic sector, selected countries**

Country	Year	Labor force, thousands				Labor force, per cent			Labor force, indices			
		Total	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary	Total	Primary	Secondary	Tertiary
Africa												
Egypt	1907	3,425	2,440	380	605	71	11	18	50.9	55.5	45.5	40.5
(1947 = 100)	1917	4,003	2,626	429	948	65	11	24	59.5	59.7	51.4	63.5
	1927	5,250	3,525	556	1,169	67	11	22	78.0	80.2	66.6	78.2
	1937	6,095	4,308	610	1,177	71	10	19	90.6	98.0	73.1	78.7
	1947	6,729	4,398	835	1,496	65	13	22	100.0	100.0	100.0	100.0
	1960	7,769	4,403	918	2,448	57	12	31	115.5	100.1	109.9	163.7
Morocco	1952	2,872	2,064	304	504	72	11	17	100.0	100.0	100.0	100.0
(1952 = 100)	1960	2,856	1,863	370	623	65	13	22	99.4	90.3	121.7	123.4
South Africa	1911	3,698	2,186	577	935	59	16	25	75.3	90.4	56.2	63.8
(1946 = 100)	1921	4,231	3,018	547	666	71	13	16	86.2	124.8	53.3	45.4
	1946	4,910	2,418	1,026	1,466	49	21	30	100.0	100.0	100.0	100.0
	1960	5,200	1,698	1,602	1,900	33	31	36	105.9	70.2	156.1	129.6
Anglo-America												
United States	1870	12,925	6,910	2,830	3,185	53	22	25	22.1	94.3	13.1	10.8
(1950 = 100)	1880	17,392	8,682	4,139	4,571	50	24	26	29.8	118.4	19.1	15.5
	1890	23,318	10,121	5,973	7,224	43	26	31	39.9	138.1	27.6	24.5
	1900	29,073	11,122	7,894	10,057	38	27	35	49.7	151.7	36.5	34.1
	1910	39,371	11,834	11,622	13,915	32	31	37	67.4	161.4	53.7	47.2
	1920	42,434	11,719	13,951	16,764	28	33	39	72.6	159.9	64.5	56.8
	1930	47,492	10,753	15,498	21,244	23	33	44	81.3	146.7	71.7	72.0
	1940	50,074	9,317	17,560	23,197	19	35	46	85.7	127.1	81.2	78.7
	1950	58,442	7,331	21,623	29,488	13	37	50	100.0	100.0	100.0	100.0
	1960	63,574	4,519	24,470	34,585	7	39	54	108.8	61.6	113.2	117.3
Canada	1901	1,782	761	516	505	43	29	28	34.1	75.6	27.5	21.6
(1951 = 100)	1911	2,723	1,011	800	912	37	29	34	52.2	100.4	42.6	39.1
	1921	3,174	1,111	892	1,171	35	28	37	60.8	110.3	47.5	50.2
	1931	3,758	1,226	978	1,554	33	26	41	72.0	121.7	52.1	66.6
	1941	4,365	1,275	1,388	1,702	29	32	39	83.6	126.6	73.9	72.9
	1951	5,219	1,007	1,877	2,335	19	36	45	100.0	100.0	100.0	100.0
	1961	6,314	786	1,958	3,570	12	31	57	121.0	78.1	104.3	153.0
Latin America												
Argentina	1947	6,066	1,622	1,827	2,617	27	30	43	100.0	100.0	100.0	100.0
(1947 = 100)	1960	6,831	1,460	2,470	2,901	21	36	43	112.6	90.0	135.2	110.9
Ecuador	1950	1,151	641	266	244	56	23	21	100.0	100.0	100.0	100.0
(1950 = 100)	1960	1,433	839	263	331	59	18	23	124.5	130.9	98.9	135.7
Jamaica	1953	579	300	106	173	52	18	30	100.0	100.0	100.0	100.0
(1953 = 100)	1960	596	237	147	212	40	25	35	102.9	79.0	138.7	122.5
Mexico	1921	4,504	3,488	561	455	77	13	10	56.9	72.3	42.5	25.6
(1950 = 100)	1930	4,957	3,626	743	588	73	15	12	62.6	75.2	56.3	33.1
	1940	5,694	3,831	746	1,117	67	13	20	71.9	79.4	56.6	63.0
	1950	7,917	4,824	1,319	1,774	61	17	22	100.0	100.0	100.0	100.0
	1960	11,250	6,145	2,148	2,957	55	19	26	142.1	127.4	162.9	166.7
Salvador, El	1950	632	413	96	123	65	15	20	100.0	100.0	100.0	100.0
(1950 = 100)	1961	799	485	137	177	61	17	22	126.4	117.4	142.7	143.1
Asia												
India	1951	101,775	71,809	11,329	18,637	71	11	18	100.0	100.0	100.0	100.0
(1951 = 100)	1961	187,162	137,546	21,516	28,100	73	12	15	183.9	191.5	189.9	150.8
Japan	1920	26,773	14,661	5,721	6,351	55	21	24	67.0	81.2	64.4	48.9
(1954 = 100)	1930	29,049	14,687	5,951	8,411	51	20	29	72.7	81.3	67.0	64.7
	1954	39,930	18,060	8,880	12,990	45	22	33	100.0	100.0	100.0	100.0
	1960	43,681	14,346	12,964	16,371	33	30	37	109.4	79.4	146.0	126.0
	1963	47,270	13,800	14,540	18,930	29	31	40	118.4	76.4	163.7	145.7
Pakistan	1951	21,551	17,125	1,637	2,789	79	8	13	100.0	100.0	100.0	100.0
(1951 = 100)	1961	29,954	22,645	2,859	4,450	76	9	15	139.0	132.3	174.6	159.6

Reprinted from Thoman, Conkling & Yeates, The Geography of Econonomic Activities, p. 94-95.

Country	Year	Labor force, thousands: Total	Primary	Secondary	Tertiary	Labor force, per cent: Primary	Secondary	Tertiary	Labor force, indices: Total	Primary	Secondary	Tertiary
Philippines	1948	6,749	4,875	739	1,135	72	11	17	100.0	100.0	100.0	100.0
(1948 = 100)	1962	9,576	5,898	1,358	2,320	62	14	24	141.9	121.0	183.8	204.4
Thailand	1947	8,882	7,624	211	1,047	86	2	12	100.0	100.0	100.0	100.0
(1947 = 100)	1954	10,226	9,020	265	941	88	3	9	115.1	118.3	125.6	89.9
	1960	13,520	11,334	585	1,601	84	4	12	152.2	148.7	277.3	152.9
Communist Europe												
Poland	1931	14,487	9,752	2,538	2,197	67	18	15	117.6	137.5	89.1	92.4
(1950 = 100)	1950	12,314	7,090	2,847	2,377	58	23	19	100.0	100.0	100.0	100.0
	1960	13,907	6,637	4,028	3,242	48	29	23	112.9	93.6	141.5	136.4
Yugoslavia	1931	6,394	5,099	717	578	80	11	9	86.5	97.3	60.1	60.4
(1953 = 100)	1953	7,390	5,240	1,193	957	71	16	13	100.0	100.0	100.0	100.0
	1961	7,825	4,748	1,834	1,243	61	23	16	105.9	90.6	153.7	129.9
Non-Communist Europe												
France	1866	16,643	8,535	4,384	3,724	51	26	23	86.9	161.6	61.3	54.9
(1954 = 100)	1881	16,544	7,890	4,444	4,210	48	27	25	86.1	149.4	62.1	62.0
	1896	18,935	8,501	5,660	4,774	45	30	25	98.5	161.0	79.1	70.4
	1906	20,721	8,855	6,338	5,528	43	30	27	107.8	167.7	88.6	81.5
	1921	21,720	9,024	6,662	6,034	41	31	28	113.0	170.9	93.1	88.9
	1936	20,260	7,204	6,379	6,677	36	31	33	105.4	136.4	89.2	98.4
	1954	19,220	5,280	7,154	6,786	28	37	35	100.0	100.0	100.0	100.0
	1962	19,498	3,908	7,431	8,159	20	38	42	101.4	74.0	103.9	120.2
German	1929	17,877	5,274	7,347	5,256	30	41	29	82.8	103.1	77.6	75.0
Fed. Rep.	1939	20,055	5,299	8,424	6,232	27	42	31	92.9	105.6	89.0	88.9
(1950 = 100)	1950	21,590	5,114	9,468	7,008	24	44	32	100.0	100.0	100.0	100.0
	1963	26,866	3,172	13,097	10,597	12	49	39	124.4	62.0	138.3	151.2
Great Britain	1881	12,795	1,638	6,372	4,785	13	50	37	56.9	146.8	57.5	46.5
(1951 = 100)	1891	14,646	1,582	7,176	5,888	11	49	40	65.1	141.8	64.7	57.3
	1901	15,394	1,385	7,158	6,851	9	47	44	68.5	124.1	64.6	66.6
	1911	17,842	1,550	9,023	7,269	9	51	40	79.4	138.9	81.4	70.7
	1921	18,759	1,381	9,142	8,236	7	49	44	83.4	123.7	82.5	80.1
	1931	20,894	1,258	9,717	9,919	6	47	47	92.9	112.7	87.7	96.5
	1951	22,482	1,116	11,086	10,283	5	49	46	100.0	100.0	100.0	100.0
	1961	24,399	948	11,655	11,796	4	48	48	108.5	84.9	105.1	114.7
Italy	1881	15,050	8,600	3,850	2,600	57	26	17	76.9	104.1	61.2	51.7
(1951 = 100)	1901	15,962	9,443	3,879	2,640	59	24	17	81.5	114.3	61.7	52.5
	1911	16,402	9,086	4,387	2,929	55	27	18	83.8	110.0	69.7	58.3
	1921	18,431	10,264	4,508	3,659	56	24	20	94.1	124.2	71.7	72.8
	1931	18,281	9,356	4,924	4,001	51	27	22	93.4	113.3	78.3	79.6
	1936	18,346	8,843	5,375	4,128	48	29	23	93.7	107.0	85.5	82.1
	1951	19,577	8,261	6,290	5,026	42	32	26	100.0	100.0	100.0	100.0
	1963	19,912	5,341	8,147	6,424	27	41	32	101.7	64.7	129.5	127.8
Sweden	1910	2,116	1,016	565	535	48	27	25	68.7	160.8	44.6	42.2
(1950 = 100)	1920	2,565	1,058	808	699	41	32	27	83.2	167.4	63.8	55.2
	1930	2,872	1,041	927	904	36	32	32	93.2	164.7	73.2	71.3
	1940	2,966	864	1,070	1,032	29	36	35	96.2	136.7	84.5	81.5
	1950	3,082	632	1,267	1,183	21	41	38	100.0	100.0	100.0	100.0
	1960	3,234	447	1,463	1,324	14	45	41	104.9	70.7	115.5	104.5
Oceania												
Australia	1911	1,939	480	668	790	25	34	41	64.5	96.4	58.6	57.7
(1947 = 100)	1921	2,296	532	790	974	23	34	43	76.4	106.8	69.3	71.2
	1933	2,673	588	935	1,150	22	35	43	88.9	118.1	82.0	84.1
	1947	3,006	498	1,140	1,368	17	38	45	100.0	100.0	100.0	100.0
	1954	3,702	498	1,503	1,701	13	41	46	123.2	100.0	131.8	124.3
	1961	4,139	459	1,661	2,019	11	40	49	137.7	92.2	145.7	147.6

SOURCES: "The World's Working Population: II. Its Industrial Distribution," *International Labor Review*, **73**:501–521, 1956. International Labor Office, *Yearbook of Labor Statistics*, Geneva, 1938, 1950, and 1964.

TABLE C-2

Rates of Growth of Labor Force, and the Rate of Change of Employment in Agriculture, Mining, Industry, and Services.

Twelve Countries 1954–64

	Rate of Growth of Labor Force	Rate of Growth of Employment* in Agriculture and Mining	Rate of Growth of Employment† in Industry and Services: Total	Industry	Services
Japan	1.5	–2.6	5.4	5.8	5.1
Italy	–0.1	–4.5	3.9	4.4	3.2
W. Germany	1.4‡	–4.1‡	2.8‡	2.7‡	2.9‡
Austria	0.2§	–3.6§	2.3	2.0	2.6
France	0.2	–3.5	2.2	1.9	2.4
Denmark	0.8‖	–2.8‖	2.2‖	2.5‖	1.9‖
Netherlands	1.3	–2.0	2.3	1.9	2.7
Belgium	0.3	–4.4	1.9	1.5	2.3
Norway	0.3	–2.5	1.3	0.5	2.0
Canada	2.3	–2.8	3.5	2.3	4.3
U.K.	0.6	–2.3	1.1	0.6	1.6
U.S.	1.3	–2.4	1.8	0.8	2.4

*Including Self-Employed and Unpaid Family Workers
†Wage and Salary Earners
‡1957–64
§1951–63
‖1955–64

Percentage Composition of Total Employment Between Primary, Secondary, and Tertiary Occupations.

TABLE C-3

Twelve Countries, 1962–63 average (in percentages)

	PRIMARY (Agriculture and Mining)	SECONDARY (Manufacturing, Construction & Public Utilities)	TERTIARY (Services)*	Total
Japan	30.0	30.3	39.7	100
Italy	27.8	39.4	32.8	100
Austria†	23.8	40.6	35.6	100
France	21.1	37.0	41.9	100
Norway	20.8	33.8	44.5	100
Denmark	19.1	39.5	41.4	100
West Germany	14.3	42.6	39.5	100
Canada	12.9	32.7	54.4	100
Netherlands	12.0	42.3	45.7	100
Belgium	9.4	40.6	48.2	100
U.S.	8.9	30.7	60.4	100
U.K.	6.7	44.0	49.3	100

*Includes Transport, Distribution, Financial and other Services, Public Administration, etc.
†1961.

Source: Kaldor, Strategic Factors in Economic Development, p. 36 & p. 38.

TABLE C-4

LABOUR FORCE DISTRIBUTION BY MAJOR INDUSTRY GROUP: 1931-1961

Industry	1931 Number 000's	1931 Percent	1941 Number 000's	1941 Percent	1951 Number 000's	1951 Percent	1961 Number 000's	1961 Percent
Total Civilian Labour Force	3,917.6	100.0	4,196.0	100.0	5,214.9	100.0	6,342.3	100.0
Primary	1,293.3	33.0	1,320.6	31.5	1,111.7	21.3	903.3	14.2
Agriculture	1,124.0	28.7	1,082.3	25.8	827.2	15.9	640.4	10.1
Forestry and Fishing	97.5	2.5	145.0	3.5	180.6	3.5	143.6	2.3
Mining	71.8	1.8	93.3	2.2	103.9	2.0	119.3	1.9
Secondary	1,093.5	27.9	1,209.9	28.8	1,717.1	32.9	1,963.1	31.0
Manufacturing	800.0	20.4	983.9	23.4	1,364.7	26.2	1,494.7	23.6
Construction	293.5	7.5	226.0	5.4	352.4	6.7	468.4	7.4
Tertiary	1,530.4	39.1	1,657.4	39.5	2,328.8	44.7	3,344.1	52.7
Electricity, gas and water	28.1	0.7	25.9	0.6	62.0	1.2	70.5	1.1
Transportation and communication	317.0	8.1	292.3	7.0	433.5	8.3	500.2	7.9
Trade	395.6	10.1	468.4	11.2	711.3	13.6	931.8	14.7
Finance	93.1	2.4	90.4	2.2	144.2	2.8	229.7	3.6
Community and business service	251.4	6.4	277.7	6.6	431.2	8.3	764.4	12.1
Government service	100.8	2.6	117.2	2.8	203.5	3.9	363.3	5.7
Recreation service	18.8	0.5	17.7	0.4	28.7	0.6	39.8	0.6
Personal service	325.6	8.3	367.9	8.8	314.4	6.0	444.4	7.0
Industry not stated	0.5	0.0	8.0	0.2	57.2	1.1	132.0	2.1

Source: Noah M. Meltz, *Changes in the Occupational Distribution of the Canadian Labour Force, 1931-1961*, Table A-5, (Ottawa, Queen's Printer, 1965).

It was argued earlier that the method of allocating energy resources cannot, and will not, reverse Ontario's lack of energy compared to such other provinces as Alberta and British Columbia. There is an urgent need for the people of Ontario to come to accept a slower rate of economic growth. However, given the advantages of location which the province continues to enjoy, Ontario will remain an attractive site for industries that are not energy-intensive. As the Ontario economy matures further in the 1980s, one can expect the tertiary sector, which is labour-intensive, to contribute most to employment growth in the province. Technology intensive manufacturing processes should also contribute to employment. It may, however, be necessary to encourage this development through deliberate policy and planning, in order to mitigate the dislocations that a lack of growth in the energy-intensive industries may cause.

IV. LIGHT INDUSTRY CASE STUDY: POWERTRONIC EQUIPMENT LTD, SCARBOROUGH

A. INTRODUCTION

The impact of major electrical rate changes on light industry might be very different from the impact on some large manufacturing firms, which often enjoy more diversity and flexibility in their production processes. Hardest hit would be firms that have low profit margins and compete with manufacturers that benefit from lower energy costs.

In choosing an alternative, the following criteria were used: firm competes with Quebec and/or American firms; a one-shift operation; small size; willingness to co-operate; and proximity to Metropolitan Toronto (this last was due to constraints on time and money). Another original criterion which required electrical costs to constitute 3 per cent or more of value added, was dropped, because most manufacturers in light industry fall far short of such a percentage. Thus the impact of changes in rate levels and structures on light industry should not, by itself, be dire.

The first firm chosen for study was involved in manufacturing parts for small cars. The intense competition and low profit margins that characterize this industry made the company an interesting subject, but the need for confidentiality caused management to withdraw its support. As an alternative, Powertronic Equipment Ltd of Scarborough was chosen, since it seemed to meet most of the criteria. This case was based on telephone conversations and a personal interview with the company's vice-president, Mr Dave E. Bawden.

B. CASE STUDY

1. Introduction

Powertronic Ltd is a small private manufacturing-firm employing about 150 people at its one plant, in Scarborough. Its product line is small commercial and industrial electrical devices, such as rectifiers, inverters, D.C. converters, and battery chargers. Its customers can be divided into four main classes: the steel industry, telecommunication companies, electrical utilities, and general industry. This last group mainly buys battery chargers from Powertronic for its lift trucks.

Monthly sales amount to some $450,000. A general breakdown of sales by geographical location would be as follows: 40 per cent to Ontario, 30 per cent to Quebec, 10 per cent to the U.S., and the remainder mainly to the Maritimes. In Canada, Powertronic faces competition from five companies, three in Ontario, one in Vancouver, and one in Montreal. The company faces no real competition from imported American products because of such factors as tariff barriers, fluctuations in exchange rate, the small size of the market, and the importance of service.

Nearly half of shipment value is for raw materials, copper, steel, and aluminium being the main products purchased. Another 15 per cent goes to labour. Hydro costs represent only 0.33 per cent of shipment value. The company's electrical consumption and power bill are shown on Table 1. The very low load factor of 33 per cent is due to production control procedures, which require various tests which, in turn, result in high peak demands. The load factor is also low because the company uses only one shift. Most of the electricity in the plant is used for lighting, testing, and power tools. There is thus no single main source of energy consumption related to the production process.

TABLE 1

- Powertronic's Load Profile and Monthly Bill in 1975 -

Date	Billing Demand kW	kWh (excluding water services)	L.F.	NET AMOUNT* (excluding water services) $
Jan.-1975	329	71,100	29.6%	1,518.84
Feb.	367	74,400	27.7%	1,659.12
March	383	71,100	25.4%	1,663.92
April	324	88,800	37.5%	1,626.00
May	265	60,800	31.4%	1,318.65
June	336	98,700	40.2%	1,732.50
July	342	87,000	34.8%	1,669.20
Aug.	299	93,600	42.7%	1,584.27
Sept.	288	76,200	36.2%	1,426.20
Oct.	336	74,400	30.4%	1,526.40
Avg/month	327	79,610	33.6%	1,572.51

* Obtained by using Scarborough P.U.C. industrial Rate Structure:

$1.00 per kW demand charge
2.40 cents for first 100 hours of billing demand
1.10 cents for second 100 hours of billing demand
.70 cents for the remainder kWh.

2. Impact of Scenario A

Under Scenario A,[47] Powertronic's electrical costs (assuming similar load profiles for all years) would be as shown in Table 2.

TABLE 2

	1975	1978	1983
Electrical cost per month	$1,576	$2,995*	$4,728*
% increase	-	90	200

* Scenario A assumes that bulk-power rates double by 1978. The effect on customer rates would be as follows:

1978 - all less than 5000 kW rates = 1.9 x (1975 rates)
1983 - all less than 5000 kW rates = 3.0 x (1975 rates)

The direct impact of these increases on profit margin or prices would obviously be minimal, because of the small percentage of total cost spent on electricity. The firm's Ontario competitors would also face similar increases. As for the outside competition, the effect on the relative competitive position would again be minimal, again because of the small percentage of product value which is electrical, and because all firms will face a certain increase in their electrical rates.

[47]Scenario A assumes a doubling of bulk power rates by 1978. The effect on customer rates would be as follows: 1978 - all less than 5000 kW rates = .9 x (1975 rates) and 1983 - all less than 5000 kW rates = 3.0 x (1975 rates).

Second-order impacts through increased costs for raw materials would have greater consequences for Powertronic. About 30 per cent of raw material value (or $67,500 per month) is in the form of copper. Assuming that about 4000 kWh[48] are used per ton of copper purchased, (mainly for copper wire), and that approximately 65 tons are used per month, then 270,-000 kWh are used to produce Powertronic's monthly copper requirements. At an average total cost of 1.0 cent per kWh[48], the electrical share of copper costs is $2,700, or 4 per cent. If hydro rates doubled by 1978, Powertronic's copper costs would increase by $2,700 per month if (a) the firm passed on all cost increases to the clients of the copper wire companies and (b) all Powertronic's copper were produced in Ontario.

Similarly, 20 per cent of Powertronic's outlay for raw materials goes for steel. At an approximate consumption rate of 400 tons per year, and assuming that about 500 kWh[48]are used per ton of purchased. then 200,000 kWh are used to produce Powertronic's yearly steel requirements. Doubling hydro rates could thus increase steel costs by $2000 a year, or $167 a month.

Other raw-material components would be affected by increased hydro rates, but not appreciably For example, most aluminium Powertronic buys comes from Quebec or British Columbia, and therefore higher hydro rates in Ontario would not affect its price.

The expected impact of higher electrical rates on Powertronic would thus be as shown in Table 3.[49]

TABLE 3

	1978	1983
Increase in monthly electrical bill from 1975	$1,419	$3,152
Increase in monthly copper costs* from 1975	2,700	5,400
Increase in monthly steel cost* from 1975	167	333
Total increase/ month	$4,286	$8,885
% of monthly sales	1	2

The actual cost increases as a percentage of shipment value in future years will be lower, because the dollar amount of sales will increase owing to general inflation. On the other hand, higher electrical rates might have some other second or higher-order impacts which the above calculations have not allowed for. Thus increased hydro rates in accordance with Scenario A would probably result in cost increases of about 0.8 per cent of sales value in 1978, and about 1.0 per cent in 1983.[50] Since most of Powertronic's competitors will suffer similar increases[51] the higher costs will most probably be passed on to the customers through higher prices and/or modified equipment design. In fact, the company enjoys a fair degree of flexibility in the design of its products, which enables it to cushion the impact of cost increases in many ways.

3. Impact of Scenario B

Under Scenario B (again assuming similar load profiles for all years), Powertronic's electrical costs would be as in Table 4.[52]

TABLE 4

Unadjusted Increases in Monthly Hydro Bill

	1975	1978	1983
electrical cost/ month	$1,576	$2,959*	$4,647*
% increase	-	88	195

* Obtained by using Scenario B rates for the 50-3000 kW customer class:

	1978	1983
$C.C.	$400/customer/mo.	$630/customer/mo.
¢/kW	1.81¢/kWh	2.84¢/kWh
$/k	$3.42/kW	$5.37/kW

Thus cost increases are very slightly smaller in Scenario B than in Scenario A. When looking at the percentage increase, one must remember that Powertronic is served by the Scarborough utility, which presently uses the traditional rate structure. This rate is characterized by a low demand charge as such ($1 per kW, as compared to the average $2.50 most municipal utilities charge), and an energy rate tied to the kW use through the hours-use rate. Thus Powertronic's low load factor presently results in a higher energy charge than similar users with a higher load factor pay.

This brings up an important point. Scenario B, which imposes standard demand and energy rates across the province, would have very different impacts on different retail customers, since the rates they are charged at present differ vastly in structure from municipality to municipality. (Although only a dozen or so utilities presently use traditional rates, those dozen serve over half the population of Ontario.)

[48]Obtained from Power Market Analysis, Ontario Hydro.

[49]Assuming that (a) all increases in electrical costs are passed on to customers by steel and copper suppliers and (b) all steel and copper purchased is produced in Ontario

[50]Assuming a price increase of approximately 8 per cent a year for Powertronic's products

[51]Even some of the competitors outside Ontario might buy their raw materials from the same supplier, and thus suffer similar cost increases.

[52]Obtained by using Scenario B rates for 50 - 3000 kW customer class.

Faced with such rates, Powertronic could try to improve its load factor by decreasing its peak demand. The present low load factor is partly caused by the testing-procedures used at the plant for production control. These tests could certainly be carried out at off-peak hours. Mr Bawden saw no problems in doing this, since the staff needed for the tests consists of a small team of technically skilled employees who would not object to such a shift. Such an approach might reduce the present average monthly peak demand by 100 kW, giving a load factor of close to 50 per cent. The resulting monthly electrical costs would thus be as in Table 5.

TABLE 5
Adjusted Increases in Monthly Hydro Bill

	1975	1978	1983
electrical cost/month	$1,576	$2,617	$4,111
% increase	-	66	161

Whether Powertronic would actually implement this program for reducing load factor is questionable, seeing that the incentive already exists. If Powertronic had reduced its peak demand by 100 kW in 1975, its monthly bill would have been approximately $300 less. This amount is very close to the saving which would result in 1978 under Scenario B, if the load factor were improved. Again, this demonstrates one of the peculiarities in going from a traditional rate to the type of rate Scenario B exemplifies.

Other reductions in electrical consumption would be only slight. (The electricity consumed is mainly for lighting, testing, and machine tools.) As for any retrofit conservation devices considered in the future, an implied payback period of five years or less would be required, according to Mr Bawden.

Scenario B also considers peak versus off-peak rates for commercial and industrial firms. Under this scenario, Powertronic would be charged for non-coincident peak demand measured between 700 and 2300 hours. Thus by shifting all of its operations to the off-peak period, Powertronic could reduce its demand charge by nearly 100 per cent. However, Mr Bawden sees this alternative as impractical, because increased costs for night-time labour would more than offset any reduction in hydro costs[53]
This alternative would be more attractive for capital-intensive manufacturers, who would have more to gain because of their higher energy consumption and lower labour costs per unit. Other beneficiaries of peak versus off-peak rates would be firms that already use three shifts in their production process. These would have more flexibility in shifting their peak demand to the night than one-shift manufacturers such as Powertronic

C. SUMMARY

Powertronic is labour-intensive, and electrical costs represent only one third of 1 percent of shipment value. Increases in electrical rates would result in higher expenditures for Powertronic, mainly through increased costs for raw materials such as copper and steel. In fact, total costs might increase by 1 per cent of sales value, because of changes in hydro rate levels in accordance with Scenario A. The nature of the industry would probably cause those cost increases to be passed on to the customers through higher prices and/or design modifications. Under Scenario B, Powertronic would suffer similar cost increases, and impacts would be similar.

Finally, Powertronic would not benefit from peak versus off-peak rates, since any reductions in electrical costs from night-time operations would be offset by increased labour costs. Peak versus off-peak rates would rather benefit manufacturers who already use three shifts of labour.

[53]Mr Bawden estimates that a premium of 10 per cent is needed for night-time labour. Powertronic's present monthly labour costs of $70,000 would thus increase by $7,000, a figure which far exceeds its total electrical costs.

V. MUNICIPAL UTILITY CASE STUDY: GUELPH HYDRO

A. INTRODUCTION

Guelph Hydro is a medium-sized municipal utility, which served 19,455 customers in 1974. Some general statistics for it are shown in Table 1. Its total revenues per kWh are slightly below the provincial average, mainly because of the revenue from the 'general less than 5,000 kW' customer class which is 10 per cent under the average. Its total costs for primary power per kW and kWh are very close to the average for municipal utilities. Table 1 also shows that Guelph's distribution of sales, revenues, and customers is very close to the average for all municipalities.

Guelph Hydro is one of the fifteen utilities which was using traditional (or Wright) rates as of July 1, 1975.[54]
Accordingly, it charged different rates to its three classes of non-residential customers: small commercial, commercial, and industrial.

As for its residential customers, it had been using a special rate for flat-rate water heaters, but new installations are now metered and no special rates are applied.

Guelph has experienced average growth in the past few years. Its net fixed assets grew from $7,416,546 in 1970 to $9,644,733 in 1974, an increase of 30 per cent. Total sales in kilowatt-hours increased at an average annual rate of six per cent over this period, as compared to 7 per cent for the provincial average.

(Net fixed assets grew by about 29 per cent for all municipal utilities from 1970 to 1974.)

In spite of this fast growth, Guelph Hydro's financial position in 1974 was very good, showing a debt-equity ratio of 8:92 (compared to the overall ratio of 14:86 for all utilities). Its main source of funds is accumulated net income invested in plant or held as working capital. Accumulated net income made up 67 per cent of Guelph's equity base in 1974, while contributed capital made up only 15 per cent.

A breakdown of Guelph Hydro's expenses is shown in Table 2.

Bulk-power costs represented 80.6 per cent of total expenses in 1974. Compared to (for example) Mississauga, Guelph's administration costs are much higher on a percentage basis (6.9 per cent against 4.1), but its low debt-equity ratio results in low financial expenses (2.5 per cent for Guelph as opposed to 6.4 per cent for Mississauga).[55]

Guelph Hydro was represented in the case study by Mr Gord Stacey, General Manager, and Mr Harold Hewhitt, Secretary and Treasurer.

B. SCENARIO A

Bulk-power rates under Scenario A (i.e., a doubling of rates by 1978) would severly affect Guelph's total expenses. These rates would cause controllable costs (OM&A and financial) to become a smaller share of total expenses, and so reduce the municipal utility's control over the rates it charged its customers. In fact, as things stand, bulk-power costs are estimated to make up 82 per cent of 1976 expenses.

However, in one important area officials from Guelph utility reacted differently (to Scenario A) from Mississauga officials. Guelph officials do not foresee any reduction in the reliability of the system, as opposed to Mississauga where expected cutbacks in capital outlays might result in more frequent and longer power interruptions. Guelph Hydro, therefore, does not expect increasing consumer criticism.

The chief impact of Scenario-A-type bulk-power rates would be on capital spending and capital availability, since value added to sales by the municipal utility is dropping as uncontrollable (bulk-power) costs become a greater percentage of total costs. This problem is compounded because at present the municipality of Guelph is restricting new debenture issues (1976 borrowing, for example, is held to 1975 levels). Thus Guelph Hydro's low debt-equity ratio might be maintained to the same level even though there might be an increasing need for new financing as bulk-power rates increase.[56] As was mentioned previously, Guelph Hydro's net fixed assets grew by 30 per cent from 1970 to 1974. In future years, it is expected that the municipality will continue to grow, with the residential sector growing faster than the commercial or industrial. On a per-dollar sales basis, more capital is needed to service these customers (as compared to commercial

[54] Since March 1, 1976, Guelph Hydro has been using general-type rates for all non-residential customers.

[55] This financial information was obtained from Ontario Hydro's *Statistical Yearbook* (1974). In obtaining these figures, Hydro seeks to ensure a uniform classification of revenues and expenditures, to permit comparisons to be made between municipal utilities

[56] Guelph Hydro officials doubted that the utility could completely pass on drastic increases in bulk-power expenses to its retail customer through rate increases. The result would therefore be lower net income and a need for more outside financing

TABLE 2

	Guelph		All Municipalities
Expenses (1974)			
Power purchased	$6,573,104	80.6%	79.4%
Operation & Maintenance	362,775	4.4%	6.9%
Administration	565,404	6.9%	6.5%
Financial	166,481	2.5%	2.4%
Depreciation	445,027	5.4%	4.5%
Other	44,571	0.2%	0.3%
	$8,157,362	100.0%	100.0%

TABLE 1

1974 Statistics for Guelph Municipal Utility

	Guelph	% Breakdown	Total for Municipal Utilities	% Breakdown
Total Sales - kWh (,000)	594,632	100	50,237,588	100
-residential service	179,085	30	14,811,689	29
-general (under 5,000 kW)	308,749	52	26,553,483	53
-general (over 5,000 kW)	100,822	17	8,343,999	17
-street lighting	5,976	01	528,418	01
Total Revenue - $ (,000)	8,103	100	711,420	100
-residential service	2,950	36	241,838	34
-general (under 5,000 kW)	3,960	49	375,188	53
-general (over 5,000 kW)	1,114	14	87,018	12
-street lighting	79	01	7,377	01
Total Customers	19,455	100.0	1,872,461	100
-residential	17,786	91.0	1,654,065	88
-general (under 5,000 kW)	1,667	8.6	218,295	12
-general (over 5,000 kW)	2	0.4	101	-
Revenue per kWh - ¢	1.36		1.42	
-residential	1.65		1.63	
-general (under 5,000 kW)	1.28		1.41	
-general (over 5,000 kW)	1.10		1.04	
Monthly Peak Load - kW	99,345			
Monthly Energy Purchased (,000 kWh)	51,109			
Monthly Load Factor	70%			
Total Charge for Primary Power				
$ per kW	66.46		66.84	
Mills per kWh	10.77		10.62	

* Source: Ontario Hydro: Statistical Yearbook, 1974.

or industrial). As opposed to Mississauga, Guelph only charges residential developers the difference between underground and overhead distribution costs if the new buildings are wired underground. A capital shortage therefore could have some impact on the residential sector. However, Guelph officials estimated that the overall growth rate in the capital-spending program might decline in the next few years, following a smooth curve.

To cope with the problem of rapidly rising bulk-power rates and the associated capital shortage, Guelph Hydro would consider some of the following alternatives:

1. Phasing out rental of hot-water heaters in four to five years, to free some capital for other purposes. New installations are now metered (as opposed to the old flat-rate system), and the trend is to charge only for the price of energy in the kWh rate and charge separate rental, service, and installation charges. Guelph officials do not expect a shift to other energy sources for water-heating, because other utilities (such as gas) are also facing capital shortages and might phase out their own rental plans.
2. To reduce the costs of operations and maintenance, Guelph intends to adopt preventive maintenance. It is also expected that increasing technological sophistication in these areas will keep costs down. Guelph does not forecast great increases in the maintenance budget, or in reconstruction costs, over the next few years. It is expected that the system will require more reinforcing than repair, because of increasing load.
3. Other cost-reducing steps considered are:
   a. Reduce overtime work in non-emergency situations (such as night-time hot-water failure);
   b. Contract out such items as line surveillance, on-site customer maintenance, and meter reading, whenever that would reduce costs;
   c. Use a longer meter-reading schedule (every six months), with a system of equal monthly payments. As was stated in the study of Hydro Mississauga, the impact of this measure on customers' consumption patterns might very will be of utmost concern to those advocating conservation. That is, *longer feedback periods might reduce the consumer's sensitivity to certain price signals, and thus substantially reduce the effectiveness of certain rate structures in promoting a conservation ethic amongst end customers.*

By increasing its efficiency and effectiveness, Guelph Hydro expects to be able to cope with the impacts of Scenario A without reducing the reliability of its service.

As for customer criticism, Guelph faces no organized opposition, and presently receives few complaints. As rates rise sharply in the next few years, Guelph Hydro does not expect the situation to change greatly. In fact, it intends to make good use of public relations to educate its customers in the need to keep costs under control through such measures as overtime restrictions.

C. SCENARIO B

Scenario B also includes a doubling of bulk-power rates by 1978, but imposes province-wide uniform kW and kWh rates on retail customers of municipal utilities. Also included in the retail rate structure under Scenario B is a flat monthly customer charge.[57]

Guelph officials favoured the concept of the customer charge, but questioned how fair it would be for some customers at the margin of the three customer classes. Moreover, Guelph Hydro does not believe it would avail itself of special distribution levy on new construction to reduce local distribution costs (and hence customer charge). According to Mr Stacey, introducing such a scheme would probably be unfair, in that it would apparently discriminate against the tenants (or owners) of new complexes.

Table 3 demonstrates how much Guelph Hydro's revenues from certain customers would increase by 1978 if Scenario B rates were applied. From this table, one can observe the following:

1. Revenues from the residential sector would less than double by 1978. Low use customers (250 kWh per month) could face increases as low as 25 per cent. Conservation is thus rewarded with lower rate increases to produce a still lower bill.
2. As with Mississauga, commercial and industrial customers (under 3,000 kW) would face percentage increases that varied tremendously, depending on their kW consumption and load factor.

The customers in the range of 50 to 150 kilowatts would face the highest increases (as much as 242 per cent). The percentage increase would also become larger as the customer's load factor increased for the same kW demand (except for customers in the range of 50 to 100 kilowatts). Compared to Mississauga, the percentage increases are very similar for low load factors but smaller for high load factors (about 14 per cent less).

Guelph has only three customers taking more than 3,000 kilowatts. One of these, Guelph University, is by far the largest user in the municipality. An appendix to this case discusses how this large customer might react to Scenario B.

Prohibiting bulk metering for new multi-family dwellings would impose significant added costs on Guelph Hydro. However, Scenario-B-type rates, with a fixed monthly customer charge, should offset the metering costs that individual metering would impose on the utility. On the other hand, prohibiting bulk metering should have little effect on the utility's bad debts, because it now imposes a substantial deposit on residential customers.

As for peak versus off-peak rates and interruptible power, the municipal utility has no objections to these but questioned their practicality. Only three of Guelph's customers use more than 3,000 kW, the University being larger than the other two combined. As is explained in the appendix, the university's ability to adapt to such schemes depends on making conservation policy changes to which the engineering department would have an input. As for the other two customers, Mr Stacey believed that their labour content was too high for them to make much use of interruptible power.

Note on Scenario B Rates

Scenario B rates are sensitive to changes in the demand-energy split and the rate design, including the differential between marginal costs and the revenue requirement and hence the level of the customer charge.

[57]For description of scenarios A and B, see Section III of the Hittman Report, Volume XA.

TABLE 3

Percentage Increase in Guelph Hydro's Revenues with Scenario B Rates

A. RESIDENTIAL

	Monthly Consumption & Bills							Annual Consumption & Bills		
	Customer Charge	Minimum Bill		Low Use	Medium Use			High Use		
				250	500	750	1,000	20,000	30,000	40,000
	$	$	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
1975 rates		3.50	100	8.75	10.70	13.90	16.08	343.70	471.30	598.90
Scenario B (1978)	4.00	-	-	10.93	17.85	24.78	31.70	602.00	879.00	1156.00
% increase				25%	67%	78%	97%	75%	87%	93%

B. SMALL COMMERCIAL, COMMERCIAL, AND INDUSTRIAL (Under 3,000 kW)

Comparative Monthly Bills

Consumption			1975 Guelph Rates (Commercial)	1978 Scenario B Rates	% Increase		
kW	kWh	LF	$	$	LF .27	LF .41	LF .68
10	2,000	27	44.00	59.40	35%		
	2,993	41	52.44	86.91		66%	
	4,964	68	69.19	141.50			104%
50	10,000	27	220.00	752.50	242%		
	15,000	41	262.50	842.50		221%	
	24,820	68	345.97	1,020.24			195%
100	20,000	27	440.00	1,104.00	151%		
	30,000	41	525.00	1,285.00		145%	
	49,640	68	606.94	1,640.48			195%
500	98,550	27	2,185.50	3,893.75	78%		
	150,000	41	2,625.00	4,825.00		84%	
	250,000	68	3,475.00	6,635.00			91%
1,000	197,100	27	4,371.00	7,387.51	69%		
	300,000	41	5,250.00	9,250.00		76%	
	500,000	68	6,950.00	12,870.00			85%
2,000	394,200	27	8,742.00	14,375.02	64%		
	598,600	41	10,488.10	18,074.66		72%	
	992,800	68	13,838.80	25,209.68			82%

C. INDUSTRIAL (Over 3,000 kW)

See section on Guelph University

When Scenario B was developed in September 1975, projections had to be made of what marginal costs, adjusted down to the revenue requirement, might look like. When the actual marginal costs are made available for the municipality of Guelph, analysis may suggest (for instance) lower customer charges than in Scenario B; if so, a recalculation of relevant impacts can be made. If reductions in proposed rates make it unlikely that 1978 impacts will be as severe as those outlined in the case studies, the 1978 impacts can be treated as postponed to 1979.

D. SUMMARY

Major increases in rate levels such as those of Scenario A would have important consequences on Guelph Hydro. Compared to Hydro Mississauga, Guelph does not foresee longer and more frequent power interruptions as one of the effects of rapidly rising bulk-power rates. According to Mr Stacey, General Manager, the main effect would be to increase efficiency and sophistication in the management and maintenance of the system. Capital availability and cost would certainly be a problem, but providing reliable service would remain the utility's overriding goal. One must also note that, unlike Mississauga, Guelph expects its growth rate to decline or stabilize over the next few years. This might partly explain the difference in the two utilities' reaction to Scenario A.

As for Scenario B, Guelph officials favoured new rates that would provide customers with better pricing-signals and recover identifiable operating-costs from customer charges unrelated to kWh charges. However, they were not convinced that the rate structure as presently defined, with three customer classes, was fair.

The percentage increases in revenues from the various customer classes under Scenario B rates are similar to those forecast for Mississauga, except for low-use residential customers and commercial customers with high load factors where percentage increases would be significantly smaller.

Finally, the benefits of peak versus off-peak rates and interruptible power were not sufficiently quantified to measure the effect on consumption patterns. Guelph officials doubted the potential for selling interruptible power to the three large customers, because of the overriding importance of labor costs. An interview with officials from Guelph University, which is by far the utility's largest customer, led some support to this view. Nevertheless, whereas the university now uses no interruptible power, it could in the future use it for about 10 per cent of its total load.

VI. PRELIMINARY IMPACT STUDY ON LOW-INCOME HOUSEHOLDS

A. INTRODUCTION

Writing a study of the impacts of changes in rate levels and structures on the low-income group is at present a nearly impossible task. Much of the required information is not yet available, and this paper will therefore limit itself to considerations which should be of use in further in-depth research. Data for such research are now being compiled from Federal Government sources.

The first problem in such a study is that of correlating income with consumption of electricity. It is expected that these data will be available from the Federal Government within the next few months. Income data from Statistics Canada will be correlated with consumption data provided (on the household basis) by Ontario Hydro. This should provide some much needed insights on the correlation of income and consumption of electricity. For example, proponents of lifeline rates have often argued that low income users of electricity consume less because, on the average, they have fewer appliances. Other analysis (Joe Pace's for instance) maintains that many low-income customers consume more electricity than the average residential customer, and would therefore be hurt by lifeline rates.

The relationship between these two variables also depends on other factors which must be considered for meaningful results. For example, the relationship between income and power consumption might be directly proportional overall but inversely proportional for certain sub groups such as apartment dwellers. In fact, a recent review by the Impact Committee showed that three apartment buildings of the Ontario Housing Corporation in Toronto consumed, for domestic services only, from 240 to 280 kWh per suite.[58]
The average amount of electricity used by apartment dwellers is estimated at 200 to 225 kWh. (Again, no definite conclusions can be drawn at present, since no report has been written on the average domestic consumption for comparable apartment units. These figures were estimates provided by Mr F. Thompson, from Toronto Hydro's Commerical and Residence Service Department.) These low-income tenants might consume either more or less electricity than higher-income tenants.

This point brings to light many problems with the impact of such schemes as Lifeline rates. Lifeline rates might, for example, result in the following unexpected or unintended impacts: subsidizing tenants at the expense of homeowners; subsidizing cetain high-income tenants at the expense of certain low-income tenants; subsidizing electrically heated units at the expense of units heated with gas or oil; subsidizing low-density dwellings at the expense of high-density ones.[59]

B. SCENARIO A

What would be the impact of electricity rates based on average cost on low-income households? Obviously, one would first have to estimate what the impact would be on the consumption of kilowatt-hours: the price elasticity, for instance How could one obtain such a non-aggregated estimate of price elasticity? One possible approach would be to obtain saturation statistics for household appliances for the low-income group, and then estimate probable reductions in saturation or use of the appliances on the basis of whether the appliance is a 'luxury' or a 'necessity'. This was the approach the Rand Corporation used in its impact study for the western United States and California.[60]

Another American study, by the Energy Policy Project of The Ford Foundation, supported these conclusions.[61] This report's findings were based on two national surveys, which investigated the relationship between energy use and various socio-economic factors. (Such surveys are so rare that the report states that it was "a pioneering effort".) Energy consumption was found to be directly proportional to income, but the variation in energy consumption was less pronounced than the difference in income. The percentage of a family's income spent on energy declined as income increased as shown in the accompanying table.

Income	Percentage of total annual income spent on electricity: U.S., 1972-3	Canada, 1969
$ 2,500	5.2	2.3
$ 8,000	2.1	1.1
$14,000	1.5	0.9
$24,500	1.1	0.6

The study then explained how the ability of the poor to reduce their energy consumption was limited. For example, lack of insulation and storm windows causes low-income households to use more energy per square foot of housing for heating. Lack of capital makes it impossible for these families to improve their insulation. As for lighting (which, on the average, consumes one seventh of a household's electricity), the poor usually light one or two rooms, as compared to three or more for the well to do. Moreover, the affluent may be less diposed to reduce their consumption than the poor, since electricity absorbs a smaller share of their incomes. This suggests the burden of certain conservation policies (such as across-the-board rate increases under declining-block rates, as at present) would fall more heavily on the poor.

The study also attempted to estimate the annual *indirect energy* use (for example energy used in producing the home appliances) per household by income groups. The gap between rich and poor in indirect use was even larger than in direct use. In fact, it was estimated that the affluent use three times more indirect energy than the poor. (Thus, the indirect impact of rate increases would be more drastic, in absolute terms, for the affluent.)

In short, the study concludes that

> *The more money people have, the more energy they use. But the poor spend almost 15 percent of their household income on energy, while the high consumption of fuel by the rich typically accounts for only 4 percent of their incomes. Any major energy price increases will thus cause hardship to poor families, since their energy use levels do not include a margin of extra amenities easily done without.*

[58] Ontario Housing Corporation Statistics.
[59] See Section IV of Volume 6.
[60] *The Impact of Electricity Price Increases on Income Groups: Western United States and California*, The Rand Corporation, November 1972.

[61] *A Time to Choose, America's Energy Future: Final report by the Energy Policy Project of the Ford Foundation*, Ballinger Publishing Co., Cambridge, Mass., 1974.

To place the impact of electrical rates on the working poor in perspective, some calculations were made to find out what percentage of a hypothetical low-income family's gross income might be used for electricity in 1978 if either rates based on average costs or illustrative rates based on marginal costs were in use. The results are shown in Appendix II. It was found that for a monthly consumption of 750 kilowatt-hours, the electric bill could represent as much as 6.3 per cent of the gross 1978 income of the working poor.

C. SCENARIO B

How would rates based on marginal costs affect low-income households as compared to average cost rates? Marginal cost based rates impose a uniform rate per kWh for any level of consumption. This should benefit low users of electricity more than average-cost-based rates, which simply raise the level of the declining block rate structure presently used by municipal utilities and Ontario Hydro. The declining block-rate structure charges more per kWh for low levels of consumption. Thus for low-income households that use less electricity than high-income households, marginal-cost-based rates would have less of an impact on the low-income group.

Two case studies by the Impact Committee, on the Mississauga and Guelph municipal utilities, provide some specific examples of the impact of a set of rates based on marginal costs for various residential consumption levels. For example, it was found that a consumer using only 250 kWh a month would face increases in the electric bill by 1978 (over 1975 with constant kWh consumption of 25 per cent lived in Guelph and 49 per cent in Mississauga. These compared with an increas of 90 per cent under rates based on average costs.[62]

Another aspect of the proposed rate structure which might have a significant impact on low-income households is the proposal to abolish bulk metering for new multi-family dwellings. Individual metering might reduce shelter costs if (a) rents were lowered to take into account that tenants pay for electricity and (b) low-income (and all other) tenants reduce their kWh consumption, and thus their electric bill, in response to the newly visible price signal. Those with low incomes and conscientious conservers would thus be spared from subsidizing (as they do now) middle-income heavy users that waste electricity in bulk metered apartments.

In order to study the possible effects on low-income households, the Impact Committee looked at some of the buildings owned by the Ontario Housing Corporation, because data were readily available. This government corporation owned 71,068 housing units in 1974, which it rented to households with an average income of $489 per month (for Metro Toronto in 1975). However, future studies on this subject might be more conclusive if they did not involve OHC tenants or buildings. In fact, OHC units display many distortions in the impact of electrical rates, because they are subsidized in so many different ways. For example, only 41 per cent of OHC's 1974 tenants were income earners. The rest received some welfare or benefits which partly subsidized their cost of shelter including electricity. Even income earners are subsidized for shelter, their rent is based on a fixed percentage of their income. (about 20 per cent). Probably, then, tenants of subsidized housing units have a much higher disposable income than the working poor and welfare recipients not receiving rent subsidies. Discussions with provincial authorities in the Income Security division of the Ministry of Community and Social Services confirmed that statistical data on the working poor are very expensive to obtain, and the data now available are highly unreliable. It is hoped that the income-kWh correlation expected from the Federal Government will provide some information on this group.

Meanwhile, the tenants of the public housing represent a group that could face substantial effects if master metering were abolished. These tenants would face a full electric bill for the first time. Ontario Housing officials conjectured that rents might be correspondingly reduced, yet we note the ministry's budget for 1976-77 has been reduced from what it was in 1975-76. Non-earners whose welfare cheques are geared to the Consumer Price Index (which includes the cost of electricity) may face a problem: there would a substantial time lag between when rate increases took effect, when the CPI index began to reflect them, and when an allowance for them began to appear in the welfare cheque. Yet than welfare recipients may face the impact of a full electric bill if rents are not correspondingly reduced where ever they live. At the time of writing the future of rent review is so uncertain that one cannot say with any degree of certainty that rents will be correspondinly reduced, or remain so.
At the time of writing rent review practice is so uncertain as to its outcomes that one can not say with any degree of certainty that rents will be correspondingly reduced.

[62]See "Municipal Utility Case Study: Guelph Hydro" (Vol. XB) "Municipal Utility Case Study: Hydro Mississauga" (Vol. XA).

The forecast of labour costs in the absence of wage guidelines is as follows:

Year	Percentage Change in Labour Costs
1975	14.5
1976	16.0
1977	14.0
1978	11.0
1979	10.0
1980	10.0

Source: Ontario Hydro, Office of the Chief Economist, October 1975.

Proceeding in accordance with Section B, average annual wages have become larger (Table 1), and produced different estimates of the employment effect of rate increases (Table 2). At first sight, one would think that employment would be higher at a lower wage rate, and vice versa. Table 2 apparently belies these first thoughts, for the loss of employment has actually diminished with higher wages (cp. Table B-6). To understand this anomaly, one must go back and look at the methodology. After the costs of both inputs, electricity is calculated by dividing annual wages into additional electricity costs. It can be easily seen that as the denominator (wages) becomes larger, the quotient (loss of employment opportunities) diminishes. This is exactly what has happened in Table 2.

TABLE 2

Industry	% of Labour Force
Abitibi Paper	28.4
Domtar Ltd.	11.3
Spruce Falls	9.8
Ontario-Minnesota	7.4
Dryden Paper	7.0
E.B. Eddy	6.5
Ontario Paper	6.5
Great Lakes Paper	6.0
Kimberley Clark	3.7
Others	13.4
	100.0

Source: PMA-74-11, Energy Use in the Pulp and Paper Mills in Ontario.

TABLE I

ONTARIO PULP AND PAPER INDUSTRY

Year	Establishments	Employment	Selling Value of Factory Shipments $'000	Production		Total Production '000 Tons	Value Added by Manufacturing Activity $'000	Ontario's GPP Current $'000,000	% of GPP Shipments
				Wood-Pulp '000 Tons	Paper & P.B.* '000 Tons				
1958	42	20,218	447,109	(2,533)**	2,355	(4,888)**	217,526	13,488	3.13
1959	40	20,471	452,432	(2,568)**	2,431	(4,999)**	217,351	14,118	3.20
1960	40	20,318	478,256	2,967	2,550	5,517	232,568	14,638	3.27
1961	39	16,416	482,418	2,981	2,491	5,472	233,568	15,360	3.14
1962	38	16,358	508,612	3,052	2,558	5,610	253,460	16,335	3.11
1963	38	16,609	523,478	3,074	2,563	5,637	259,112	17,795	2.94
1964	39	17,162	560,224	3,317	2,768	6,085	273,137	14,543	2.87
1965	37	17,365	574,647	3,357	2,819	6,176	285,844	21,661	2.65
1966	36	17,945	622,102	3,587	2,980	6,567	306,340	24,473	2.54
1967	35	17,830	627,728	3,619	2,946	6,565	296,173	26,336	2.38
1968	36	17,537	649,532	3,644	2,953	6,597	299,490	29,215	2.22
1969	36	17,936	715,966	3,961	3,181	7,142	340,195	32,638	2.19
1970	36	17,832	732,424	3,969	3,178	7,147	342,949	35,314	2.07
1971	37	17,132	728,289	3,800	3,119	6,919	330,373	38,128	1.91
1972	37	16,970	778,067	3,937	3,235	7,172	335,675	42,657	1.82
1973	37	17,326	932,061	4,128	3,548	7,676	450,338	48,801	1.91

Source: Statistical Review, Statistics Canada 36-204

* not including billborards
** not including soda and semi-chemicals

Figure B-1 postulates the usual demand curve. The upward shift of the supply curve from SS to S'S' reflects the increase in electricity costs per unit of output. The intersection of DD and S'S' now represents the new market equilibrium. Two things are observed, namely, the product selling-price has increased, and the quantity produced has decreased. But the increase in product price falls short of the total increase in unit cost which is measured by OP_1-OP'. Therefore the producer bears an amount equal to OP_0-OP' after the price has up to P_1P_0. The share between the producer and the consumer, depends of course, on demand elasticity. The more elastic the demand is, the higher the share that the producer must bear, and vice versa.

FIGURE B-1

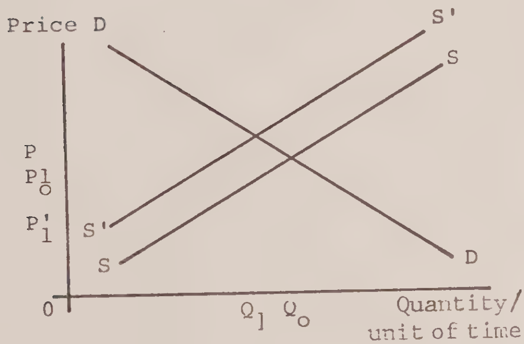

FIGURE B-2

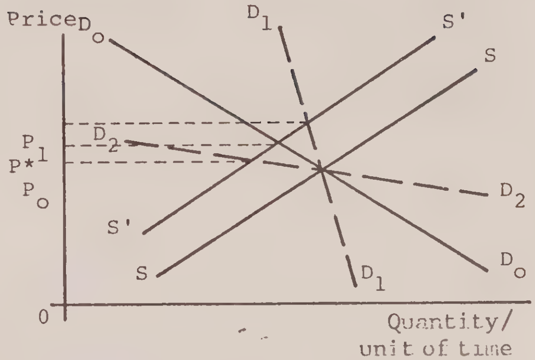

Figure B-2 illustrates three cases of elasticities. D_1D_1 and D_2D_2 stand for inelastic and elastic demands respectively, while D_0D_0 is an intermediate case. Clearly, the price increase identified with D_1D_1 (D_2D_2) is higher (lower) than that identified with D_0D_0.

The customer is assumed to maximize his utility function defined over n goods subject to his income constraint. Thus is derived the demand function which relates the demand for a good (say x_1) to the level of income and the prices of the n goods (including the price of x_1. Let q_1 denote the quantity of x_1 demanded, and y and p_1, p_2, p_n refer to income and the prices of the n goods, respectively. The demand function is represented by $q_1 = q_1(y, p_1, p_2 \ldots p_n)$.

The market demand for x_1 is derived by aggregating the individual demand functions. If the regression model is correctly specified and estimated, we obtain an equation of the form q_1
$= a + b$
$+ E_1p_1 + E_2p_2 + \ldots + E_np_n$ where
denotes an aggregate quantity. B_1 then represents the estimated price elasticity of the demand for x_1.

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APPENDIX IV: Guelph University

In 1975 the University of Guelph consumed 80.9 million kWh, with an average monthly billing-demand of 12,837 kW and a yearly billing-cost of almost $1 million. In 1974 its demand represented over 12 per cent of Guelph Hydro's total average monthly peak demand. This makes the university the lagest user of electricity in the municipality. To see how this important customer could react to Scenario-B-type rates, an interview with some officials of the university's engineering department was held on 9 February 1976. The University was represented by Mr John Flowerdew and Mr George Martin.

The university has already reacted to expected increases in power rates, and began a conservation program several years ago. The program resulted in savings of 600 kW through reduced lighting (10 per cent of total lighting, or five per cent of average total monthly peak demand). Other measures, such as better insulation for old building and public relations, resulted in a total reduction of about 14 per cent in the university's kWh consumption per gross square foot in 1974, compared to 1973. This significant decrease was achieved without any important policy change or inconvenience to the staff or students. This model program has been well discussed in provincial conservation seminars. Rates based on marginal costs would substantially increase the economic reward for further conservation.

The university's summer load is about a third more than its winter load, because of its air-conditioning system (space and water-heating by nonelectrical energy). Its three chillers have a combined capacity of 5,000 kW, and are mainly used in the period from June to October. During three of those five months, only a third of the university's 12,000 students are in residence. Nevertheless, most areas are air-conditioned during these months because (a) the engineering department has no say in the scheduling of classes and (b) the centralized control system greatly minimizes flexibility. Thus, major policy changes might very well reduce power consumption further.

Applying Scenario B rates to Guelph University's 1975 consumption would raise its power costs over the 1975 level by 112 per cent in 1978 and 233 per cent in 1983 (the university's high load factor of 72 per cent contributes to this high increase). However, Scenario B would offer several ways by which the university might control its power costs.

First, peak versus off-peak rates might be offered, where the non-coincident peak demand would be measured only between 700 and 23000 hours. This could greatly reduce the university's power costs in summer. In fact, the university has been considering adding another chiller to the system, which would peak at night by using a large water tank. To shave 2,000 kW off the peak, it is estimated that a total of $1.85 million would have to be spent on storage capacity and other items. Such a step would save $50,000 yearly in electrical costs by 1978, and over $100,00 by 1983. The decision to shift the air-conditioning load to night-time may need further study. Moreover, the university is facing a capital shortage, which further complicates the situation.

Interruptible power may be of limited use to the university because of (a) the nature of its operations and (b) its 88-per-cent co-incident peak. Thus the university would be most often subject to interruptions at times when it considers its electrical power to be firm. The university could make restricted use of the interruptible option for about 10 per cent of its total load. In fact, it owns two emergency generators, with a combined capacity of 1,800 kW, which it could use at times of interruption (these generators are presently used as peak shavers).

Prohibiting bulk metering would have minimal effect on the university's student housing. Most of the student housing consists of rooms only (approximately 4,000 beds), and the prohibition of bulk-metering might not apply to such dwellings.

Finally, seasonal rates would benefit the university, since its air-conditioning system makes its summer peak about a third higher than its winter one. However, the seasonal rates might not cause further load shifting, because the university's operations are necessarily seasonal.

In conclusion, it is indeed questionable whether the university would, or could, react to Scenario-B-type rates. Peak versus off-peak rates could prove beneficial, but the increased costs of adding storage capacity might offset the savings. Interruptible power could be used to a small extent, maybe 10 per cent of total load. The ability of the university to make further use of special features like those of Scenario B would largely depend on how much authority was entrusted to the engineering department. If the university continues the past policy of deciding such matters as class schedules without consulting the engineering department, then it will have little flexibility in energy decisions. Finally, seasonal rates would benefit Guelph University because of its summer peak; and prohibiting bulk metering would have minimal effect on its operations, since it mainly houses its resident students in single rooms.

APPENDIX V: Television Viewing and Income

To gain some insights into whether low-income families do indeed have a more home- centred lifestyle (and therefore use more electricity), the Impact Committee briefly surveyed some social studies on the matter. More specifically, surveys relating television viewing to income were examined, since television viewing is probably a good proxy indicator of lifestyle and an important source of power consumption in some households.

Only two studies relating these two variables were found. Neither produced a complete relationship between income and television viewing. However, the partial results they did are shown below.

1. In Canada, *Research Studies for the Special Senate Committee on Mass Media* produced the two following observations:
   a. in 1970, children watched a median of 12 hours of television a week. Those in families earning less than $6,000 watched, on the average, 13 hours a week, while those in families earning over $10,000 a year watched 11 hours a week.
   b. 74 per cent of families under the $4,000 line watched television news daily, as compared to 61 per cent of families over $12,000.[63]
2. A U.S. government study revealed that in 1970 families with incomes of less than $5,000 a year watched 2 to 3 times as many violent television programs as the group earning over $15,000 a year.[64]

Thus low-income families watched more television in three categories: violent programs, news, and children's programs. This data would thus tend to support the argument that low-income families have a more homecentred life than higher-income ones. The Rand Corporation's study on The Impact of Electricity Price Increases on Income Groups: Western United States and California used similar data to support this same argument. They state that in Lansing, Michigan low-income groups watched television 5.2 hours a day, compared with a general figure for the population of 2.0 hours. Moreover, low-income teenagers in Philadephia averaged 5.45 hours in front of the television set on a typical Sunday, compared to 3.7 hours for middle-class teenagers.[65]
However, no definite conclusions can be reached for Ontario Hydro's customers on the basis of the data presently available.

[63] *Mass Media: Good, Bad or Simply Inevitable. Research Studies for Special Senate Committee on Mass Media*, Vol. III, Queen's Printer, Ottawa, 1970.
[64] *Television and Social Behavior*, Volume IV of *Television in day-to-day life - Patterns of Use*, Technical Report to Surgeon General on Scientific Advisory Committee on Television and Social Behavior, U.S. printing office, Washington, D.C., 1972.
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APPENDIX VI: Hypothetical Low-Income Household[66]

To place the impact of electrical rates on the working poor in perspective, this appendix will demonstrate what percentage of its gross income a hypothetical low-income family might spend on electricity.

We first assume the following income: 40-hour week x \$2.40/hr[66] = \$96 per week, or \$417 per month.

The accompanying table shows the percentage of this income required to pay for various levels of power consumption under the 1975 rates of the various Ontario municipalities:

The above table shows the great differences that exist in rates between municipal utilities. Thus at present the impact of electric rates on low-income households varies significantly from municipality to municipality.

Using the 1976 minimum wage of \$2.65 per hour, and assuming a wage increases of 8 per cent in 1977 and 6 per cent in 1978 (in accordance with the guidelines of the Anti-Inflation Board), our hypothetical worker would have an income of \$527 a month by 1978. But that may be a cautious forecast, since the policy of the Federal Government is not to apply the guidelines strictly at the lower end of the wage scale. (The actual minimum wage is set by the province.)

Illustrative marginal-cost-based rates have been calculated for selective municipalities and the rural retail system in Volume VIII.

The eight municipal rates analysed here are neither the lowest nor the highest, and may therefore be viewed as more representative of the magnitude of impacts on low-income households.[67]

Comparative Bills as Percentage of Minimum Wage

Consumption 750 kWh per month

	% 1975	% 1978 ACP	% 1978 MCP
Mount Brydges	2.6	4.0	4.3
Oakville	3.7	5.0	6.3

Consumption 500 kWh per month

	% 1975	% 1978 ACP	% 1978 MCP
Mount Brydges	2.1	2.8	2.8
Oakville	3.0	3.8	3.4

Mount Brydges has the lowest cost of the eight municipalities whose illustrative average-cost and marginal-cost-based rates are compared in Volume VIII. Oakville has the highest.

These are representative levels of use for households not using electric heating. Data for the rural system for 1975 show an average monthly consumption of 580 kWh. Since electricity prices in general are rising more rapidly than the minimum wage, the percentage of gross income spent on electricity is increasing. That is offset in part, though, by the indexing of the basic and dependent income-tax exemptions to the previous years' increase in the Consumer Price Index.

66Ontario minimal hourly rate from 1 May 1975.

67*Monthly Rates & Comparative Bills - July 1975*, Regions and Marketing Branch, Ontario Hydro, 1975.

1975 Comparative Monthly Bills**

			$	% of gross income
Low-use:	250 kWh/month	- lowest bill	4.40	1.1
		- highest bill	11.40	2.7
		- Ontario Hydro bill***	11.02	2.6
Medium use:	500 kWh/month	- lowest bill	6.90	1.7
		- highest bill	16.98	4.1
		- Ontario Hydro bill	14.52	3.5
	750 kWh/month	- lowest bill	8.50	2.0
		- highest bill	20.38	4.9
		- Ontario Hydro bill	18.02	4.3
	1000 kWh/month	- lowest bill	11.38	2.7
		- highest bill	22.63	5.4
		- Ontario Hydro bill	22.40	5.4

Monthly Marginal Cost Based Electricity Bills as Percentage of Forecast Minimum Wage 1978*

		Energy Charge 250 kWh	500 kWh	750 kWh	1,000 kWh
(1) Acton		$7.00	14.00	21.00	28.00
	& customer charge	2.50	2.50	2.50	2.50
	Total	9.50	16.50	23.50	30.50
	as % of income	1.8%	3.1%	4.5%	5.8%
(2) Belleville		7.00	14.00	21.00	28.00
	& customer charge	1.50	1.50	1.50	1.50
	Total	8.50	15.50	22.50	29.50
	as % of income	1.6%	2.9%	4.3%	5.6%
(3) Elora		7.65	15.30	22.95	30.60
	& customer charge	1.00	1.00	1.00	1.00
	Total	8.65	16.30	23.95	31.60
	as % of income	1.6%	3.1%	4.5%	6.0%
(4) Mount Brydges		7.00	14.00	21.00	28.00
	& customer charge	.70	.70	.70	.70
	Total	7.70	14.70	21.70	28.70
	as % of income	1.5%	2.8%	4.1%	5.4%
(5) North York		7.65	15.30	22.95	30.60
	& customer charge	1.85	1.85	1.85	1.85
	Total	9.50	17.15	24.80	32.45
	as % of income	1.8%	3.3%	4.7%	6.2%
(6) Oakville		7.65	15.30	22.95	30.60
	& customer charge	2.85	2.85	2.85	2.85
	Total	10.50	18.15	25.80	33.45
	as % of income	2.0%	3.4%	4.9%	6.3%
(7) Ottawa		7.00	14.00	21.00	28.00
	& customer charge	4.00	4.00	4.00	4.00
	Total	11.00	18.00	25.00	32.00
	as % of income	2.1%	3.4%	4.7%	6.1%
(8) Vaughan Twp		7.00	14.00	21.00	28.00
	& customer charge	3.75	3.75	3.75	3.75
	Total	10.75	17.75	24.75	31.75
	as % of income	2.0%	3.4%	4.7%	6.0%

* Customer charges and rates taken from Exhibit V-13, Volume I

** Minimum wage in Ontario is forecast as $527/mo for 1978.

In the Rural Retail System the impact of rates based on marginal cost is favourable for low and medium use. At the level of 250 kilowatt-hours a month, the bill actually falls as a percentage of the minimum wage, from 2.5 per cent in 1975 to 2.3 per cent in 1978. For any amount up to 1000 kilowatt-hours a month, rates based on marginal costs give lower bills.

While the electricity bill creeps up significantly between 1975 and 1978 as a percentage of gross wages, a more interesting impact is the total direct energy bill for a three bedroom house. As a percentage of the forecast minimum wage, this total bill would be much higher, since it would have to include a component for space heating. This information is being assembled now, and will be available at a later date.

Monthly Average-Cost-Based Electricity Bills as Percentage of Forecast* Minimum Wage - 1978

	250 kWh	500 kWh	750 kWh	1000 kWh
(1) Acton	$9.40	$15.65	$21.90	$28.15
as % of income	1.8%	3.0%	4.2%	5.3%
(2) Belleville	8.35	14.60	20.85	27.10
as % of income	1.6%	2.8%	4.0%	5.1%
(3) Elora	12.25	18.50	24.75	31.00
as % of income	2.3%	3.5%	4.7%	5.9%
(4) Mount Brydges	8.32	14.57	20.82	27.07
as % of income	1.6%	2.8%	4.0%	5.1%
(5) North York	12.98	19.23	25.48	31.73
as % of income	2.5%	3.6%	4.8%	6.0%
(6) Oakville	13.60	19.85	26.10	32.35
as % of income	2.6%	3.8%	5.0%	6.1%
(7) Ottawa	9.85	16.10	22.35	28.60
as % of income	1.9%	3.1%	4.2%	5.4%
(8) Vaughan Twp.	12.00	18.25	24.50	30.75
as % of income	2.3%	3.5%	4.6%	5.8%

* Rates taken from Appendix I, Volume 8.

Rural Retail (R-1) Electricity Bill
As Percentage of Forecast Minimum Wage
1978

	1975	1978	
	$	$Marginal Cost Based	$Average Cost Based
a) 250 kWh		8.23	
& customer charge		4.00	
Total	10.30	12.23	17.75
as % of min. wage	2.5	2.3	3.4
b) 500 kWh		16.45	
& customer charge		4.00	
Total	13.80	20.45	24.50
as % of min. wage	3.3	3.9	4.6
c) 750 kWh	17.30	24.68	
& customer charge	4.2	4.00	
Total	17.30	28.68	31.25
as % of min. wage	4.2	5.4	5.9
d) 1,000 kWh		32.90	
& customer charge		4.00	
Total	21.55	36.90	37.88
as % of min. wage	5.2	7.0	7.2